

STATE OF MAINE
PUBLIC UTILITIES COMMISSION

December 19, 2014

ORDER

ED FRIEDMAN, ET AL.
Request for Commission Investigation into
Smart Meters and Smart Meter Opt-Out

Docket No. 2011-00262

DEBORAH OLIVER, ET AL.
Request for Commission Investigation into
Central Maine Power Company and Smart
Meters

Docket No. 2012-00412

WELCH, Commissioner;¹ LITTELL and VANNOY, Commissioners

TABLE OF CONTENTS

I.	SUMMARY	3
II.	BACKGROUND	3
A.	<u>Smart Meter Proceedings</u>	3
1.	Authorization of AMI Investment	3
2.	Opt-Out Investigation	4
3.	Friedman Complaint	6
B.	<u>Law Court Decision</u>	7
III	INVESTIGATION ON REMAND	8
A.	<u>Parties</u>	9
B.	<u>Public Comments</u>	10
C.	<u>Evidence and Discovery</u>	10
D.	<u>Hearings and Post-Hearing Process</u>	11
IV.	CMP SMART METER SYSTEM	12
V.	NATURE AND EFFECTS OF RF EMISSIONS; EXPOSURE LEVELS	13
VI.	RF EMISSION STANDARDS	15
A.	<u>Federal Communications Commission</u>	16
VII.	RELATIVE RF EXPOSURE LEVELS FROM COMMON DEVICES	18
VIII.	POSITIONS OF THE PARTIES	20
A.	<u>Central Maine Power Company</u>	20
B.	<u>Mr. Friedman</u>	20

¹ Chairman Welch did not participate in this proceeding.

C.	<u>Ms. Wilkins</u>	21
D.	<u>Ms. Foley-Ferguson</u>	22
E.	<u>OPA</u>	23
IX.	DECISION	23
X.	OPINION OF COMMISSIONER LITTELL	24
A.	<u>Overview</u>	24
B.	<u>Whether a Utility Service or Facility is Safe is an Appropriate Stand Alone Inquiry</u>	25
C.	<u>The Burden of Proof is on CMP</u>	25
D.	<u>Safe Utility Practices Depend On the Purpose and Context of the Service and Facility as Well as Knowledge of the Effects and Alternatives to Fulfill the Same Service or Facility Function and Risk Mitigation</u>	26
E.	<u>A Credible Threat to Human Health and Safety Does Not Mean Any Credible Evidence of Risk is Sufficient to Create a Credible Threat</u>	29
F.	<u>The Commission is Mandated to Ensure the Safe Provision of Utility Service</u>	32
G.	<u>The Commission's Jurisdiction to Address Safe Utility Services and Facilities is Not Preempted</u>	34
H.	<u>The FCC Guidelines may be Valid but are Out of Date and Should be Reexamined</u>	35
I.	<u>AMI RF Meter RF Exposures are Far Below Other Commonly Used Consumer Devices</u>	37
J.	<u>Complainants Present Credible Studies and Witnesses that RF Radiation may Cause Possible Non-Thermal Effects</u>	38
K.	<u>Actual Testing of the Meters by Trilliant and Field Measurement Indicate RF Levels are Below all Governmental and International Standards and Well Below Other Forms of RF</u>	47
L.	<u>AMI Meters are Safe Under Average/Normal/Standard Operating Conditions</u>	50
M.	<u>Exponent has not Proven that the Meters are Safe Under the Worst Case Operating Condition as Described by Dr. Bailey</u>	53
N.	<u>Customer No-Cost Opt-Out Under Certain Conditions Represents a Low-Cost Mitigation Measure</u>	55
XI.	OPINION OF COMMISSIONER VANNOY	61
A.	<u>Overview</u>	61
B.	<u>Legal Standards and Burden of Proof</u>	63
C.	<u>Compliance with RF Emission Standards</u>	64
1.	FCC Smart Meter Certification	64
2.	Field Tests of CMP Smart Meters	65
3.	Other Field Studies	66
4.	Meter Banks	67
D.	<u>Adequacy of FCC Standards</u>	67

E.	<u>Scientific Studies and Health Impacts</u>	69
1.	The Precautionary Principle and the Hill Criteria	69
2.	Industry Bias	71
3.	Animal Studies	72
4.	Human Studies	72
5.	World Health Organization Classification of RF Emissions as Potentially Carcinogenic	73
6.	Maine CDC	74
7.	Electromagnetic Hypersensitivity	75
F.	<u>Decisions of Health and Regulatory Agencies</u>	75
1.	California Council on Science and Technology	76
2.	Michigan Public Service Commission	77
3.	Texas Public Utility Commission	77
4.	Vermont Department of Health	77
5.	British Columbia Utilities Commission	78
6.	Health Canada	78
G.	<u>Voluntary Use of Technology</u>	78
XII.	CONCLUSION	81
XIII.	ORDERING PARAGRAPH	81

I. SUMMARY

As discussed in this Order, we find that Advanced Metering Infrastructure (AMI), including the use of "smart meters," as implemented and operated by Central Maine Power Company (CMP or the Company), does not present a credible threat to the health and safety of CMP's customers and, based on the record of this proceeding is, therefore, safe.

II. BACKGROUND

A. Smart Meter Proceedings

1. Authorization of AMI Investment

CMP initially proposed to implement Advanced Metering Infrastructure (AMI) in 2007. The proposal included providing solid-state meters or meter modules to all of its customers that supported a two-way communications network and a meter data management system ("smart meters"). AMI includes smart meters, as well as the network devices and related systems that allow for automated and remote meter reading, detailed customer usage measurement and data storage, and communications to and from customer meters. AMI systems provide potential operational savings (e.g., lower storm restoration costs) and a platform for programs that allow customers to lower their energy costs through more accurate and timely information and pricing programs

that better reflect the hourly and seasonal differences in electricity costs (e.g., time-of-use rates).

Concurrent with the Commission's consideration of CMP's AMI proposal, Congress enacted the American Recovery and Reinvestment Act of 2009 (ARRA). Pub. L. No. 111-5, 123 Stat. 115 (2009). The ARRA included a provision whereby electric utilities could become eligible for grants of matching funds from the U.S. Department of Energy (DOE) for up to 50% of the cost of a qualifying Smart Grid program. *Id.* § 405; 123 Stat. 115, 143. CMP applied for a grant and, in October of 2009, received notice of a grant award of \$95.9 million.

On July 28, 2009, the Commission gave initial approval to CMP's AMI project. *Central Maine Power Company, Request for Alternative Rate Plan*, Docket No. 2007-00215(II), Order Approving Installation of AMI Technology (July 28, 2009). In that Order, the Commission stated that AMI:

[is] an important technology that will ultimately reduce utility operational costs, improve customer service and provide customers with necessary tools to use electricity more efficiently and lower their electricity bills, for example, by reducing or shifting usage during high cost periods in response to market price signals. In particular, AMI and associated systems are necessary to provide customers with the option of obtaining rates that are time-differentiated to more closely reflect the actual power costs through the day.

Id. at 2.

The Commission subsequently granted final approval for the installation of CMP's AMI project on February 25, 2010. *Central Maine Power Company, Request for Alternative Rate Plan*, Docket No. 2007-00215(II), Order Approving Installation of AMI Technology (Feb. 25, 2010).

2. Opt-Out Investigation

On January 7, 2011, the Commission initiated a proceeding to consider whether CMP should provide customers with the option to "opt-out" of the installation of a smart meter on their premises. *Elisa Boxer-Cook, et al., Request for Commission Investigation in Pursuing the Smart Meter Initiative*, Docket No. 2010-00345, Notice of Investigation (Jan. 7, 2010); *Teresa Swinbourne, et al., Request for Commission Investigation into Unreasonable, Insufficient and Discriminatory Decisions to Implement the use of Smart Meters to CMP Customers Disregarding Choice in Regards to Wireless Activity and Consumer's Right to Privacy Within Their Homes*, Docket No. 2010-00389, Notice of Investigation (Jan. 7, 2010). The Commission's initiated its investigation pursuant to 35-A M.R.S. § 1302 in response to two ten-person complaints regarding the safety of CMP's smart meters, particularly with regard to the RF emissions

associated with the smart meters' communication system. The Commission limited the scope of the proceeding to the issue of whether CMP's position of not providing alternatives to the installation of a smart meter was an unreasonable, insufficient, or unjustly discriminatory utility practice.

The Commission subsequently received three other ten-person complaints regarding CMP's smart meters, and consolidated these complaints into the investigation commenced as a result of the Boxer-Cook and Swinbourne complaints. *Suzanne A Foley-Ferguson, et al., Request for Commission Investigation Into Advanced Metering Infrastructure In Accordance with the Legislature*, Docket No. 2010-00398, Notice of Investigation (Feb. 18, 2011); *Stephen & Diane Wilkins, et al., Request for Commission Investigation Into CMP's Violation of Homeowner Rights and the Exposure of the Public Health Risk of Smart Meters*, Docket No. 2010-00400, Notice of Investigation (Feb. 18, 2011); *Julie Tupper, et al., Request for Commission Investigation to Allow CMP Customers to Retain Existing Analog Meters*; Docket No. 2011-00085, Notice of Investigation (Apr. 22, 2011) (collectively with the Boxer-Cook and Swinbourne complaints, the Opt-Out Investigation).

On May 19, 2011, the Commission issued a Part I Order, and on June 22, 2011 issued a Part II Order, jointly in all five Dockets cited above (collectively, the "Opt-Out Orders").² The Commission made no specific findings regarding the safety of CMP's smart meters but, based largely on a recognition of the desire of many customers to have a choice regarding the installation of a smart meter, ordered that CMP's provide its residential or small commercial customers with two alternatives to the installation of a smart meter: (1) an electro-mechanical meter ("existing meter option"); or (2) a standard smart meter with the internal network interface card (NIC) operating in a receive-only mode ("transmitter-off option"). The Commission ordered that customers electing either "opt-out" option be assessed both an initial one-time charge and a monthly charge to cover the incremental system costs CMP would incur to provide and maintain the opt-out options.³

² Chapter 110, § 11(C)(2) of the Commission's Rules provides that the Commission may, in certain circumstances, issue a decision in two or more parts. If the Commission issues a decision in multiple parts, the first part (the "Part I Order") must plainly state the result of the decision, specify the orders made by the Commission, and summarize the factual conclusions reached by the Commission. *Id.* The second part of the decision (the "Part II Order") must contain the Commission's full statements or findings of fact. *Id.*

³ For customers that choose the existing meter option, there is a one-time charge of \$40 and a recurring monthly charge of \$12.00. For customers that choose the transmitter-off option, there is a one-time charge of \$20 and a recurring monthly charge of \$10.50. *Part I Order* at 3. Customers who are eligible for the Low Income Home Energy Assistance Program qualify for low-income assistance as follows: a customer whose income is equal to or less than 100% of the Federal Poverty Guidelines receives a 50% reduction in the initial and ongoing opt-out fees; a customer whose income is greater

On July 12, 2011, Suzanne Foley-Ferguson filed a motion to requesting that the Commission reconsider the Opt-Out Orders. *Suzanne A Foley-Ferguson, et al., Request for Commission Investigation Into Advanced Metering Infrastructure In Accordance with the Legislature*, Docket No. 2010-00398, Motion to Reconsider Order (July 12, 2011). Among Ms. Foley-Ferguson's grounds for reconsideration was information reflected in a May 2011 World Health Organization (WHO)/International Agency for Research on Cancer (IARC) report that classified RF emissions generally as a possible carcinogen (WHO Report). Ms. Foley-Ferguson also cited as grounds for reconsideration the proposition that asking people to pay to protect their health from what the WHO determined to be a possible carcinogen amounted to extorting money for a perceived public benefit in violation of the Hobbs Act (18 U.S.C. § 1951). Ms. Foley-Ferguson argued that the above information and the other grounds put forth in her motion should compel the Commission to reconsider its decision to authorize opt-out fees and instead "socialize" the costs among all ratepayers. On August 24, 2011, the Commission issued an order addressing each of Ms. Foley-Ferguson's concerns and denying her Motion. *Suzanne A Foley-Ferguson, et al., Request for Commission Investigation Into Advanced Metering Infrastructure In Accordance with the Legislature*, Docket No. 2010-00398, Order Denying Motion for Reconsideration (Aug. 24, 2011). Neither Ms. Foley-Ferguson nor any other party in the Opt-Out Proceeding filed an appeal of the Opt-Out Orders.

3. Friedman Complaint

On July 29, 2011, Ed Friedman and eighteen other persons filed a complaint pursuant to 35-A M.R.S. § 1302. *Ed Friedman, et al., Request for Commission Investigation into Smart Meter Opt-Out*, Docket No. 2011-00262, Ten-Person Complaint (July 29, 2011). Mr. Friedman's complaint was against CMP for charging its customers a fee to opt-out of CMP's smart meter program, and against the Commission for its Opt-Out Orders which required CMP to charge an opt-out fee. *Id.* at 1. Mr. Friedman requested that the Commission open an investigation to examine CMP's opt-out program based on new information released subsequent to the Opt-Out Orders and examine privacy and electronic trespass issues that the Mr. Friedman felt had not been satisfactorily addressed in the Opt-Out Investigation. *Id.* As relief, Mr. Friedman requested that the Commission stay the installation of smart meters or, in the alternative, that future installations be on an "opt-in" basis, that CMP provide opt-outs at no charge to customers, that the Commission require CMP to present information regarding health, interference, and privacy concerns associated with smart meters, and that the Commission establish a toll-free hotline within the Office of the Public Advocate where consumers could place smart meter-related complaints. *Id.* Mr. Friedman also accused CMP and the Commission of extortion in violation of the Hobbs Act and raised issues regarding the health effects of smart meters, along with privacy and trespass concerns. *Id.* at 4-5.

than 100% of the Federal Poverty Guidelines receives a 25% reduction in the initial and ongoing opt-out fees. *Part II Order* at 14.

On August 31, 2011, the Commission dismissed Mr. Friedman's complaint (Order Dismissing Complaint). The Commission stated that the opt-out options in the Opt-Out Orders addressed, in a comprehensive way, the issues raised in Mr. Friedman's complaint. *Order Dismissing Complaint* at 5. The Commission found that all of the issues raised by Mr. Friedman were raised by one or more of the parties in the Opt-Out Investigation and were considered by the Commission and resolved during that investigation or in subsequent orders on motions for reconsideration. *Id.* The Commission stated that CMP was implementing the directives contained in the Opt-Out Orders and the related orders on reconsideration; thus, CMP had taken and was in the process of taking adequate steps to remove the cause of Mr. Friedman's complaint. *Id.* Accordingly, the Commission dismissed Mr. Friedman's complaint as to CMP. *Id.* As to the portions of Mr. Friedman's complaint directed at the Commission, the Commission found that there was no statutory basis for a complaint of this type. *Id.* Accordingly, the Commission dismissed the portions of the complaint directed at the Commission as without merit. *Id.*

Mr. Friedman subsequently filed, on September 20, 2011, a motion asking that the Commission reconsider its dismissal of his complaint. The Commission took no action on Mr. Friedman's motion; the motion was denied by operation of law on October 11, 2011.⁴

On October 31, 2011, Mr. Friedman filed notice of his intention to appeal the Commission's dismissal of his complaint (Notice of Appeal). Mr. Friedman appealed the Commission's dismissal of the portions of his complaint directed at CMP and raising health, safety, privacy, trespass, and Fourth Amendment concerns. *Notice of Appeal* at 2. Mr. Friedman also appealed the Commission's dismissal of the portions of his complaint directed at the Commission itself. *Id.*

B. Law Court Decision

On July 12, 2012, after briefing and argument, the Maine Supreme Judicial Court sitting as the Law Court issued a decision on Mr. Friedman's appeal. *Friedman v. Pub. Util's Comm'n*, 2012 ME 90. The Law Court affirmed the Commission's dismissal of the portions of Mr. Friedman's complaint directed at CMP which raised privacy, trespass, and Fourth Amendment concerns. *Friedman*, ¶¶ 12. The Law Court also affirmed the Commission's dismissal of all of the portions of Mr. Friedman's complaint directed at the Commission itself. *Id.* ¶ 13. However, the Law Court reversed the Commission's dismissal of the portion of Mr. Friedman's complaint directed at CMP that raised issues regarding the health and safety implications of smart meters and remanded those issues back to the Commission for further proceedings. *Id.* ¶ 11.

The Law Court found that, while the Commission, in the Opt-Out Investigation, considered the health and safety issues raised by Mr. Friedman in his complaint, the

⁴ Pursuant to Chapter 110, § 11(D) of the Commission's Rules, any petition for reconsideration not granted within 20 days from the date of filing is denied.

Commission did not "resolve" those issues. *Id.* The Law Court then found that because the Commission explicitly declined to make a determination regarding the health concerns raised in the Opt-Out Proceeding, the Commission could not then rely on the Opt-Out Proceeding as a basis for treating the concerns in Mr. Friedman's complaint as resolved.⁵ *Id.*

III. INVESTIGATION ON REMAND

Pursuant to the Law Court remand, on July 24, 2012, the Commission opened an investigation into "the health and safety issue related to CMP's installation of smart meter technology"⁶ (Notice). In the Notice, the Commission stated that it would conduct the investigation in accordance with "the general purpose of Maine's utility regulatory system," as described in 35-A M.R.S. § 101, which states: "[t]he basic purpose of this regulatory system is to ensure safe, reasonable and adequate service" *Notice* at 1.

⁵ The Law Court also found that because the Commission had not made a finding on the safety of smart meters, the Commission was not in a position to conclude that the opt-out fee was "not unreasonable or unjustly discriminatory." Because we make the finding today that AMI, including the use of smart meters, as implemented and operated by CMP, is safe and does not present a credible threat of harm to CMP's customers or the public at large, our conclusion in the June 22, 2011 Part II Order in the Opt-Out Proceeding that the fees associated with opting-out are reasonable and not unjustly discriminatory is supported by the necessary finding regarding safety as specified by the Law Court. Regarding the reasonableness of the opt-out, the concurring opinions below take a slightly different approach regarding customers with medical treatment recommendations to avoid the AMI meters. Commissioner Littell would have CMP provide an AMI meter with transmitter off as part of the safety determination while Commissioner Vannoy would not find that necessary. Both Commissioner Littell and Commissioner Vannoy concur that this difference in approach does not vitiate their concurrence that smart meters do not present a credible threat to the health and safety of CMP's customers and are therefore safe based on the record of this proceeding.

⁶ On August 7, 2012, the Commission received a complaint signed by Deborah Oliver and twenty-three other persons against CMP. *Deborah Oliver, et al., Request for Commission Investigation into Central Maine Power Company and Smart Meters*, Docket No. 2012-00412, "Ten-Person" Complaint Pursuant to 35-A M.R.S.A. Section 1302 (Aug 7, 2012) (Ms. Oliver's complaint is dated August 6, 2012, but was filed at the Commission on August 7, 2012). Ms. Oliver requested that, in response to the July 12, 2012 Law Court decision, the Commission initiate an investigation, pursuant to 35-A M.R.S. § 1302, into health and safety concerns associated with CMP's smart meters. *Id.* at 2. Because the issues raised in Ms. Oliver's complaint are identical to issues raised in Mr. Friedman's complaint, the Commission consolidated Ms. Oliver's complaint into this proceeding. *Deborah Oliver, et al.*, Docket No. 2012-00412, Notice of Investigation and Consolidation (Sep. 26, 2012).

The Commission further clarified the scope of this proceeding after being presented with a motion by CMP to limit the investigation to a determination of whether CMP's smart meters complied with current Federal Communication Commission (FCC) RF emission standards. The Commission declined to find, as was suggested by CMP, that it was preempted from making independent findings regarding RF emissions, and stated that the applicability of the FCC standards to this investigation "is a matter that should be further explored through evidence and argument during the proceeding." *Friedman, et al*, Docket No. 2011-00262, Order Denying Motion for Order on Scope of Proceeding at 2 (Oct. 10, 2012).

A. Parties

The Commission's July 24, 2012 Notice of Investigation designated CMP as a party in this proceeding and provided interested persons with an opportunity to intervene and become full parties. *Notice* at 1-2. On August 10, 2012, the Hearing Examiners issued a procedural order stating that Mr. Friedman, as the lead complainant, is a party to the proceeding pursuant to Chapter 110, § 105(m).⁷ Further, the Hearing Examiners granted the following petitions to intervene:⁸

- Office of the Public Advocate (OPA)
- Deborah Oliver
- Diane Wilkins
- Rep. Andrea Boland
- Alan Stone
- Paulette Beaudoin
- Suzanne Foley-Ferguson
- International Brotherhood of Electrical Workers Local 1873
- Autumn Brook
- Jane Edwards
- Elery Keene
- Averyl Hill
- David Fournier
- Mary Fournier⁹
- Theodore and Cornelia Tibbals
- Mary Hankins

⁷ Since the commencement of this proceeding, the Commission has revised and updated Chapter 110 of the Commission's Rules. Chapter 110, § 105(m) is now Chapter 110, § 2(K). Further, pursuant to Chapter 110, § 2(L), the lead complainant is designated as the agent for all other signatories to a complaint filed under 35-A M.R.S. § 1302.

⁸ None of the signatories to Mr. Friedman's complaint filed petitions to intervene in this proceeding.

⁹ Mary Fournier's petition to intervene was granted over CMP's objection.

- Elisa Boxer
- Jack and Deborah Heffernan
- Jennifer Lunden
- Citizens for Health
- John Evrard
- Laurie Wolfrum
- Julie Tupper

Id.

B. Public Comments

Throughout the course of this proceeding, the Commission has received in excess of forty comments from members of the public. All public comments are available in the Commission's Case Management System (CMS) which may be accessed via the Commission's website at www.maine.gov/mpuc. The Commission also received extensive public comments in the Opt-Out Investigation (Docket No. 2010-00345).

C. Evidence and Discovery

On September 19, 2012, in support of CMP's assertion that its smart meters are safe, the Company submitted the pre-filed direct joint testimony of Dr. Yakov Shkolnikov, Ph.D. and Dr. William H. Bailey, Ph.D. (Exponent Testimony). CMP also submitted, as Exhibit B to the Exponent Testimony, an RF monitoring field study, "Measurement Validation of Exposure Predications from Central Maine Power Smart Meter Network" conducted by Dr. Shkolnikov (Exponent Study). As another exhibit to the Exponent Testimony, CMP included the joint testimony of Dr. Linda S. Erreich, Ph.D., Dr. Shkolnikov, and Dr. Bailey that was submitted on November 16, 2010 in the Opt-Out Investigation.

On February 1, 2013, Mr. Friedman submitted pre-filed testimony from Girish Kumar, Ph.D.; David O. Carpenter, M.D.; Richard Conrad, Ph.D.; Dariusz Leszczynski, Ph.D.; De-Kun Li, M.D., Ph.D., MPH; Lennart Hardell, M.D., Ph.D.; Jerry L. Phillips, Ph.D.; Lloyd Morgan, B.S. Electrical Engineering; William J Rea, M.D.; and Richard Conrad, Ph.D. Mr. Friedman also submitted lay testimony from multiple witnesses. The lay witnesses testified primarily on their perceived sensitivity to RF emissions and the associated health impacts the witnesses believe to be caused by smart meters.

Also on February 1, 2013, the OPA filed a Smart Meter RF Testing Report conducted by True North Associates and C2 Systems, and Citizens for Health submitted the pre-filed testimony of Timothy Schoechle, Ph.D.

On April 17, 2014, CMP filed the rebuttal testimony of Drs. Shkolnikov and Bailey, generally refuting the testimony of Mr. Friedman's witnesses.

The parties and Staff conducted extensive discovery throughout the proceeding, including multiple rounds of data requests and several technical conferences. Moreover, during the proceeding, the Hearing Examiners admitted over one hundred peer-reviewed scientific studies into the evidentiary record. The Commission also admitted into the evidentiary record, or took administrative notice of, several other documents related to smart meters prepared by and for other jurisdictions both in the United States and abroad, including reports from the Health Council of the Netherlands, the Vermont Department of Health, the Public Utilities Commission of Texas, the California Council on Science and Technology, the Electric Power Research Institute, the FCC, the Lawrence Berkeley National Laboratory, the Michigan Public Service Commission, the Federal Energy Regulatory Commission, and the Institute of Electrical and Electronics Engineers.¹⁰

D. Hearings and Post-Hearing Process

On August 7, 2013, the Commission held a public witness hearing at the University of Maine at Augusta. Additionally, public witnesses who were unable to attend the public witness hearing were allowed to submit written testimony provided that the testimony was submitted in affidavit form under oath. Multiple witnesses who testified at the public witness hearing submitted sworn testimony and several public witnesses put forward scientific studies for admission into the record of this proceeding as addenda to their sworn oral testimony.

The Commission held a hearing in this matter on October 30, 2013. Mr. Friedman's witness Dr. Lennart Hardell and CMP's witness Laney Brown were available for examination at the hearing.

On December 13, 2013, CMP, Mr. Friedman, Ms. Wilkins, Ms. Foley-Ferguson, and the OPA filed post hearing briefs. These parties, with the exception of Ms. Foley-Ferguson, also filed reply briefs on January 24, 2014.

On March 25, 2014, Commission Staff issued an Examiners' Report in this matter. On April 8, 2014, Ms. Wilkins filed exceptions to the Examiners' Report. On April 11, 2014, Citizens for Health, CMP, and Mr. Friedman filed exceptions to the Examiners' Report.¹¹ The parties' exceptions are discussed in Section VIII of this Order.

¹⁰ A list of the studies and reports admitted into the evidentiary record of this proceeding is attached to this Order as Appendix A.

¹¹ On April 11, 2014, the OPA filed a letter stating that the Office would not be filing exceptions to the Examiner's Report.

IV. CMP SMART METER SYSTEM

CMP's AMI system communicates and transmits metering data using a "mesh" network made up of individual customer smart meters and other devices installed throughout CMP's service territory. *Boxer Cook, et al.*, Docket No. 2010-00345, Part II Order at 2. A radio device in the smart meters communicates with other smart meters and network devices ("repeaters") within a Neighborhood Area Network (NAN). *Id.* The NANs link to the Wide Area Network (WAN) through network devices referred to as "Extender Bridges" or "Collectors." *Id.* The WAN is a high-capacity wireless communications network covering CMP's entire service area that moves information to and from CMP's Head End System (HES) using "extenders" and "gateway devices." *Id.* The HES is the "controller" for the AMI system, and coordinates information flows between CMP customers and CMP's Meter Data Management System. *Id.* at 2-3. The smart meters and other devices transmit customer usage and other data via RF signals between and among various points in the network. *Id.* at 3.

CMP's smart meters and other NAN devices communicate via an internal radio that transmits and receives radio signals at a frequency of approximately 2.4 GHz (2.4 billion cycles per second). *Boxer-Cook, et al.*, Docket No. 2010-00345, Data Request ODR-01-21. The smart meters and other NAN devices each have a single antenna and operate at an equivalent isotropically radiated power (EIRP) of between 1.6 - 2.5 watts.¹² *Data Request DW-01-10 Attch. 1.* WAN devices each have multiple antennas and communicate at a frequency of approximately 5.8GHz and an EIRP of between 4 watts and 63 watts.¹³ *Id.* WAN devices are typically mounted on pole-tops, towers, lighting structures, and occasionally on other structures such as windmills. *Data Requests DW-01-32, DW-01-30, DW-01-70.* Gateway devices transmit data approximately eight times per day and poll the extender bridges for data, on average, eight times per day. *Data Request DW-01-33.*

Other than for software updates and other occasional system communications, CMP's smart meters are expected to each generate one, 4.26 millisecond "stay alive" beat signal per hour to let the network know the smart meter is still functioning, and then generate a ten beat signal of approximately 42.6 milliseconds once per day containing energy usage information.¹⁴ *Exponent Study* at 5-6. However, because CMP's system is configured as a "mesh network," in addition to its own information a smart meter may also be transmitting information from other smart meters. *Exponent Study* at 4. The

¹² The EIRP of a device is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. *FCC, Office of Engineering and Technology*, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields" OET Bulletin 65, Edition 97-01 at 2 (Aug. 1997) (OET Bulletin 65).

¹³ 5.8 GHz is a frequency also used by many Wi-Fi routers.

¹⁴ A millisecond is one one-thousandth of a second.

number of "descendant" smart meters that a given smart meter has determines the total duration of time that the smart meter will be transmitting each day. Ninety-nine percent of CMP's smart meters have sixty or fewer descendants.¹⁵ *Exponent Study* at 9-11.

With sixty descendants, a smart meter would transmit "stay alive" signals each day for approximately 6.24 seconds (61 x 4.26 milliseconds x 24 hours), and energy usage signals each day for approximately 2.6 seconds (61 x 42.6 milliseconds) for a total signal duration of approximately 8.8 seconds per day. The vast majority of CMP's smart meters transmit for much shorter periods each day, and the average smart meter on CMP's system transmits for a total of approximately 4.4 seconds per day. *Boxer-Cook et al.*, Docket No. 2010-00345, Data Request ODR-01-29. For those meters that are in the highest one-percentile in terms of number of daily signals transmitted, *i.e.*, meters that have *more* than sixty descendants, testing demonstrated that the meters transmitted an average of approximately 35,000 signals per day. *Data Request DW 01-97*. At 4.26 milliseconds per signal, this is approximately 149 seconds, or 2.5 minutes per day. According to CMP, longer transmissions for software and firmware updates are expected to occur twice each year. *Exponent Testimony* at 4. However, due to programming and other constraints, in no event can a smart meter have more than 4,998 descendants or have a "duty cycle" (the percentage of time the smart meter can transmit) of more than 10%. *Exponent Study* at 11; *Exponent Testimony* at 4. Therefore, a smart meter cannot be sending an RF signal for more than 144 minutes each day (3 minutes out of any thirty minute period).

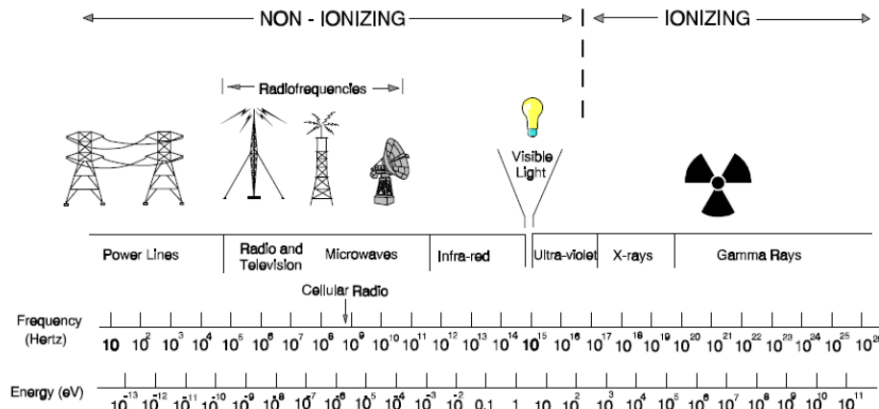
V. NATURE AND EFFECTS OF RF EMISSIONS; EXPOSURE LEVELS

According to the FCC, electromagnetic radiation "consists of waves of electric and magnetic energy moving together (*i.e.*, radiating) through space at the speed of light." *FCC, Office of Engineering and Technology*, "Frequently asked questions about the safety of radiofrequency (RF) and microwave emissions from transmitters and facilities regulated by the FCC," *available at* <http://transition.fcc.gov/oet/rfsafety/rf-faqs.html#Q1>. Signals within the electromagnetic spectrum are often referred to as electromagnetic frequencies or "EMF."¹⁶ The higher the frequency of an electromagnetic wave, the greater the energy associated with each photon of that wave. Rays with enough energy to strip electrons from atoms and molecules are referred to as

¹⁵ This is based on data collected by Trilliant, Inc., the provider of CMP's smart meters. Trilliant collected actual signal data from 1,100 randomly selected smart meters over a 13-day period and stratified the meters based on the number of beat signals transmitted.

¹⁶ A concern sometimes raised in the context of electric transmission and distribution is the EMF associated with power lines. However, unlike the EMF from smart meters which occur in what is generally considered the RF portion of the electromagnetic spectrum, the EMF associated with electricity on power lines occurs at a very low frequency (60 Hz, or 60 cycles per second, in the United States). Such low frequency EMF is often referred to as "extra-low frequency" (ELF) EMF.

"ionizing" radiation. X-rays and gamma-rays are examples of ionizing radiation and are known to cause biologic damage. Rays that do not contain sufficient energy to cause ionizing effects are referred to as "non-ionizing" radiation. RF signals fall within the non-ionizing portion of the electromagnetic spectrum. Many other common electronic devices, including cell phones, computers, cordless phones, and Wi-Fi routers, also operate at frequencies and power levels similar to those used by CMP's smart meters.



FCC, Office of Engineering and Technology, OET Bulletin 56, "Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields" at 3 (Aug. 1999) (OET Bulletin 56).

RF signals are non-ionizing and, at sufficient strength, RF signals can cause tissue heating in the human body.¹⁷ The biological effects resulting from tissue heating are often referred to as "thermal" effects. Thermal effects are a known mechanism for biological damage. Many of the standards and guidelines developed by various organizations and countries are based on an assumption that potentially harmful biological effects occur at a measure of the rate at which the body absorbs RF energy (known as the "specific absorption rate" or "SAR") of 4 W/kg, as averaged over the whole-body. *FCC, OET Bulletin 56 at 11.* Different safety factors are applied to this value to obtain each agency's limits depending upon the frequency used by the device (the most restrictive limits occur in the frequency range of 30-300 MHz where whole-body absorption of RF energy by human beings is most efficient); whether the exposure is related to the general public ("uncontrolled") exposure or for occupational ("controlled") exposure; and the expected proximity to the human body of the device when in use.¹⁸ Other, *i.e.*, non-thermal, biological effects from RF emissions have also been described and are the topic of considerable ongoing research.

¹⁷ At frequencies below 3 kHz, RF signals can also cause induced voltage gradients and/or electric currents in the body. However, CMP's meters operate at frequencies of approximately 2.5 GHz.

¹⁸ Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment, have been made fully aware of the potential for exposure, and can exercise control over their exposure. General

VI. RF EMISSION STANDARDS

The following table is a summary of some of the standards in place or proposed by governmental agencies and groups that are relevant to the frequencies used by CMP's smart meters:¹⁹

TABLE 1

Exposure Limits for the General Public (as of April 2011)		
MPE (mW/cm²)		SAR (W/kg)
<u>1 mW/cm²</u>		
United States (FCC) (30 minute avg)	<ul style="list-style-type: none"> · Romania · Slovakia 	United States (FCC): 0.08 W/kg (whole body); 1.6 W/kg (partial body)
Canada (6 minute average)	<ul style="list-style-type: none"> · Spain · Australia 	
Cyprus	<ul style="list-style-type: none"> · Austria 	Health Canada: 0.4 W/kg (whole body)
Czech Republic	<ul style="list-style-type: none"> · Sweden 	8 W/kg (over 1g of body part)
Estonia	<ul style="list-style-type: none"> · United Kingdom 	20 W/kg (over any 10g of body part)
Finland	<ul style="list-style-type: none"> · Recommendation Council of the European Union 	
France	<ul style="list-style-type: none"> · International Commission on Non-Ionizing Radiation (ICNIRC) (6 minute average) 	
Germany		International Commission on Non-Ionizing Radiation (ICNIRC) (6 minute average)
Hungary		.08 W/kg (whole body)
Ireland		2 W/kg (head and trunk)
Luxembourg		4 W/kg (limbs)
Malta		
Portugal		
<u>0.1 mW/cm²</u>		
Slovenia (certain instances)		
<u>0.06 – 0.07 mW/cm²</u>		
Greece		
<u>0.01 mW/cm²</u>		
Bulgaria		
Italy (certain instances)		
Lithuania		
Poland		
Russia		
<u>0.001 mW/cm²</u>		
ECOLOG-Institut ²⁰		

population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure.

¹⁹ All limits have been converted to mW/cm² and W/kg for comparison purposes.

²⁰ In his reply brief, Mr. Friedman reports that the ECOLOG Institut recommended standard is 0.1 W/m², or 0.01 mW/cm². *Friedman Reply Brief* at 12, 16. Mr. Friedman further states that the BioInitiative Report recommended 0.01 mW/cm². *Friedman Reply*

<u>Other Standards</u>	
Seletun Statement: 0.00017 mW/cm^2	
BioInitiative (2012) ¹⁶ : $0.0000003 \text{ mW/cm}^2 - 0.0000006 \text{ mW/cm}^2$	

Data Request DW-01-065; Health Canada, Safety Code 6.

A. Federal Communications Commission

The FCC is charged at the federal level with regulating communications by radio, television, wire, satellite and cable within the United States and its territories. The development and enforcement of the federally-mandated RF exposure standard is part of the FCC's responsibilities under the National Environmental Policy Act of 1969 (42 U.S.C. § 4321 *et seq.*) (NEPA). NEPA establishes the basis for evaluating the effect of emissions from FCC-regulated transmitters on the quality of the human environment and identifying situations where adverse health impacts may occur. The FCC is responsible for providing licenses for RF emissions and its regulations address matters relating to public health and safety and have been designed to ensure that the levels of RF emissions that consumers are exposed to are not harmful.

On August 1, 1996, after reviewing several recommendations, the FCC adopted the National Council on Radiation Protection and Measurements (NCRP's) recommended Maximum Permissible Exposure (MPE) limits for field strength and power density (power in watts per unit area). FCC, OET Bulletin 65. Before the FCC published its rule, it received endorsements from the U.S. Environmental Protection Agency (EPA), from the FDA, and from the U.S. Occupational Safety and Health Administration. FCC, OET Bulletin 56. *Public Utility Commission of Texas, Infrastructure and reliability Division*, Staff Report, "Health and RF EMF from Advanced Meters: An Overview of recent Investigations and Analyses," Project No. 40190 at 33 (Dec. 2012) (PUC TX Report).

The FCC's MPE limits apply to FCC licensees and also to the use of RF emitting equipment used in license free bands. Devices such as smart meters operate in the unlicensed spectrum for which the FCC has pre-defined rules for both the hardware and the deployment methods of the transmitting radio to ensure compliance with MPE limits. Because of this, smart meters must be tested and evaluated in certified laboratories prior to sale to utility companies to ensure their compliance with the FCC's requirements, including RF exposure limits. Such evaluations are documented in

Brief at 16. These values appear to be in error. The ECOLOG Institut report recommends a limit of 0.01 W/m^2 or 0.001 mW/cm^2 . *ECOLOG-Institut*, "Mobile Telecommunications and Health, Review of the current scientific research in view of precautionary health protection" at 37 (Apr. 2000). The 2007 BioInitiative report recommended a limit of $0.1 \mu\text{W/cm}^2$ (or 0.0001 mW/cm^2). However, in 2012, the BioInitiative group issued a revised recommendation of $0.3 \text{ nW/cm}^2 - 0.6 \text{ nW/cm}^2$ (or $0.0000003 \text{ mW/cm}^2 - .0000006 \text{ mW/cm}^2$). *BioInitiative 2012*, "Conclusions" (available at <http://www.bioinitiative.org/conclusions/>).

equipment certification reports provided by the manufacturer to the FCC. The applicable MPE for CMP's 2.4 GHz smart meters for members of the public is 10 watts per square meter (or its equivalent 1 milliwatt per square centimeter (mW/cm²)) averaged over 30 minutes. 47 CFR § 1.1310.

For devices, such as smart meters, which are normally used at a distance of at least 20 cm from the body, the FCC allows devices to be evaluated based on either the "specific absorption rate" (SAR) or the "maximum permissible exposure" (MPE) power density, but notes that the MPE is the normal measure of exposure.²¹ FCC, OET Bulletin 65 at 15. The amount of RF exposure that a person is subjected to during the signal transmission is evaluated based on the following formula:²²

$$S = PG/(4\pi R^2)$$

where:

S = power density (in appropriate units, e.g., mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

G = power gain of the antenna

R = distance to the antenna (in appropriate units, e.g., cm)

This formula demonstrates that the strength of the smart meter's RF signal drops off exponentially with increases in the distance from the transmitter. By way of example, if the power density (S) = 0.2 mW/cm² when the distance (R) = 10 cm, multiples of the distance would change the exposure as follows:

R (cm)	S (mW/cm ²)
10	0.2
10*2 = 20	0.2/(2 ²) = 0.05
10*3 = 30	0.2/(3 ²) = 0.022
10*4 = 40	0.2/(4 ²) = 0.0125

In addition, the duration of the signal is relevant to whether a device meets the FCC standard for exposure. While the FCC requires that devices like smart meters be

²¹ For devices normally used within 20 cm of the body, the FCC requires that the exposure be evaluated with respect to the "specific absorption rate" (SAR) limit which is a measure of the rate at which the body absorbs RF energy and is usually expressed in units of watts per kilogram (W/kg). FCC, OET Bulletin 56 at 13. Devices normally used at 20 cm or more away are far enough away from the RF emitter to be located in what is commonly referred to as the "far-field" zone of the radiation source, e.g., more than several wavelengths distance from a typical RF source, and therefore can be evaluated based on their MPE power density limit measured in mW/cm².

²² FCC, OET Bulletin 65 at 19. As noted in OET Bulletin 65, this equation is generally accurate in the "far-field" of an antenna but will over-predict power density in the near field, where it could be "considered a 'worst case' or conservative prediction."

tested for their peak, or maximum RF emission for compliance purposes, the exposure limits for the general population exposure are based on a power density limit of 10 watts per square meter averaged over a thirty minute time period.

Finally, we note that on March 27, 2013, the FCC released an Order on radio frequency exposure limits and policies requesting comments to determine whether its RF exposure limits and policies need to be reassessed. *FCC*, ET Docket No. 13-84, FCC 13-89, *Further Notice of Rulemaking and Notice of Inquiry* (Mar. 29, 2013) (Notice of Inquiry). The Notice of Inquiry is intended to open discussion on both the continued appropriateness of the current RF exposure limits and possible policy approaches regarding RF exposure. In the notice the FCC stated:

We continue to have confidence in the current exposure limits, and note that more recent international standards have a similar basis. At the same time, given the fact that much time has passed since the Commission last sought comment on exposure limits, as a matter of good government, we wish to develop a current record by opening a new docket with this Notice of Inquiry.

Notice of Inquiry, ¶ 205.

As of March 2014, Comments and Reply Comments have been submitted by interested citizens and industry groups in the *Inquiry* docket, but no further action or schedule has been set by the FCC.

VII. RELATIVE RF EXPOSURE LEVELS FROM COMMON DEVICES

The record in this proceeding demonstrates that CMP's smart meters result in RF exposure levels that are below the FCC limit and other RF standards, as well as other devices in prevalent use in today's society, such as cell phones.

The figures below summarize RF exposure levels from CMP's smart meters, other AMI network devices, and other common RF-emitting devices. The data derives from Dr. Shkolnikov's testimony and a study conducted by the Texas PUC. *PUC TX Report*. Similar exposure levels are also reported by the California Council on Science and Technology (CCST). CCST, Final Report, "Health Impacts of Radiofrequency Exposure from Smart Meters" (Apr. 2011) (CCST Report).

Table 2 below presents the information in tabular form, and Figure 1 in graphical form. Because the exposure levels vary by orders of magnitude, graphs in Figure 1 are presented using both a linear scale and logarithmic scale. In Figure 1 below, which uses a linear scale from 0.0 to 0.2 mW/cm², most of the devices shown have exposure levels that are relatively so small that they appear to be zero. In the expanded portion of Figure 1, each interval on the Y-axis represents a factor of 10, and the scale is from

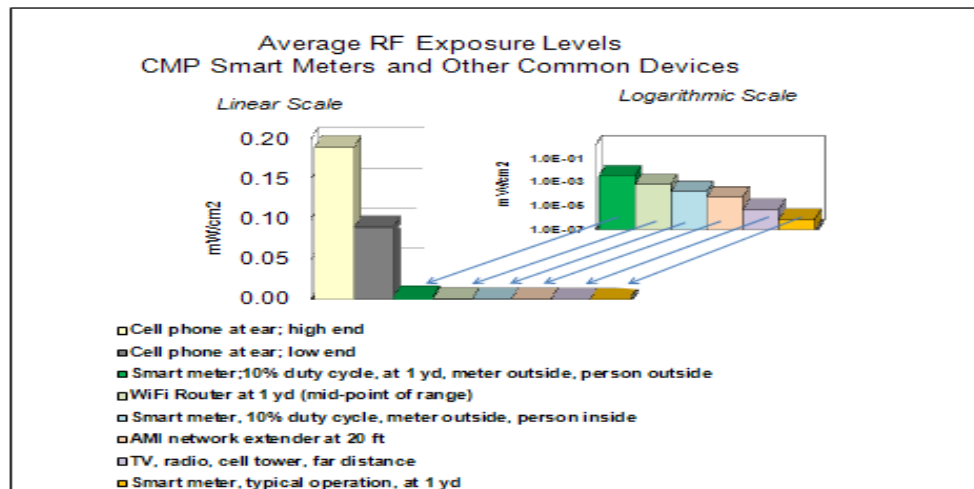
10^{-7} (one ten-millionth) to 0.1mW/cm^2 , which allows the exposure level information to be visible on the same graph, even given the differences in orders of magnitude.

TABLE 2²³

RF Exposure Levels from CMP AMI and Other Common Devices

Source: ODR-01-29 and TX Study

Device	Location	Average Exposure (mW/cm ²)	Notes
FCC limit		1.000000	
Cell phone	At ear	0.190000	High end of range
Cell phone	At ear	0.090000	Low end of range
Smart meter @ 10% duty cycle	1 yard away, meter and person outside	0.003100	Max. operating time
WiFi router	1 yard away	0.000200 to 0.001000	Constant operation
Smart meter @ 10% duty cycle	1 yard away, meter outside, person inside	0.000150	Max. operating time
AMI network device	20 feet away	0.000054	
AMI network device	60 feet away	0.000006	
TV, radio, cell towers	Typical distances away	0.000005	
Smart meter @ typical operation	1 yard away, meter outside, person inside	0.0000008	

FIGURE 1

²³ Unless specifically noted, all of the exposure levels in Table 2 assume that there is no absorptive or reflective material between the device and the subject of the exposure. Any such material (e.g., the meter enclosure, exterior siding, insulation, drywall, etc.) would necessarily decrease the level of exposure for a given distance from the device.

VIII. POSITIONS OF THE PARTIES

A. Central Maine Power Company

CMP's position is that it has met its burden to demonstrate that its installation of smart meters and associated infrastructure constitutes a safe, reasonable, and adequate utility service. CMP states that this proceeding has generated substantial scientific data that goes well beyond what is needed for the Commission to fulfill its statutory obligation to determine whether or not CMP's smart meter deployment is an unreasonable utility practice. CMP argues that the overwhelming consensus within the scientific community and among public health policy-makers, regulatory agencies, and judicial bodies throughout the world, is that wireless smart meter technology does not pose a threat to public health.

Moreover, CMP states that the record evidence in this proceeding demonstrates that (1) the Maine CDC does not have health concerns associated with smart meters; (2) CMP's AMI system complies with the FCC RF safety standards, and the current FCC RF emission standards for smart meters are adequate; (3) CMP's smart meters comply with international RF emissions safety standards; (4) as confirmed by actual field measurements, the level of RF emissions from smart meters is orders of magnitude below other natural and manmade sources of RF; (5) public health policy-makers, who have looked specifically at smart meters have concluded that meters do not pose a public health risk; (6) the health data on other wireless technologies, primarily cell phone data, do not suggest health risks at the level of RF emissions from smart meters; and (7) CMP's smart meters emit RF that are below the levels recommended by Mr. Friedman's witnesses and more stringent standards for smart meters would not meaningfully reduce an individual's overall RF exposure.

In its April 11, 2014 exceptions to the Examiner's Report, CMP urged the Commission to adopt the Examiners' Report with two minor factual changes to the description of testimony and mathematical calculations.

B. Mr. Friedman

Mr. Friedman's position is that, during this investigation, CMP has provided no affirmative proof that its AMI system does not cause adverse health effects. Mr. Friedman emphasizes that it is CMP that has the burden to prove the safety of the level of RF radiation emitted, or, ultimately, the extent of the safety risk. The burden of resolving uncertainties, in Mr. Friedman's view, must fall on the party with the affirmative obligation to ensure safety, not on the individuals who are exposed to the risk. Moreover, Mr. Friedman argues that CMP has a heightened burden of proof because a person's right to "obtain safety" is paramount in that place where the person can and should best exercise the right – the privacy of their home. Mr. Friedman concludes that CMP's failure to resolve or explain the uncertainties in the science and to provide affirmative proof of safety compels a finding against CMP.

Mr. Friedman points to the testimony from the nine expert witnesses he presented, some of whom have conducted extensive original research and who are presented as among the most qualified experts in the world on the health effects of low-level RF radiation. Mr. Friedman states that the testimony confirms that low-level RF radiation creates health and safety risks to humans and that this conclusion is further supported by hundreds of scientific studies and by the sworn lay witness testimony of dozens of people who have suffered adverse health effects from exposure to RF radiation, including smart meter radiation. According to Mr. Friedman, the risk is clear and safety is not ensured.

Mr. Friedman also argues that the testimony of CMP's witnesses – that, based on field tests, CMP's smart meters are in compliance with FCC standards – is unreliable. Mr. Friedman similarly argues that the field tests of the OPA witnesses are likewise unreliable.

In his April 11, 2014 exceptions, Mr. Friedman urges the Commission to reject the Examiners' Report. According to Mr. Friedman, the Examiners' Report "fails to decide the discrete issue the Maine Law Court directed the Commission to resolve, whether CMP's smart meters pose a credible risk of harm . . . [and] thereby fails to satisfy the Commission's statutory mandate to ensure safety." Mr. Friedman argues that the Examiners introduced irrelevant factors into their analysis and relied on information not in the evidentiary record of the proceeding. Moreover, Mr. Friedman contends that in the Examiners' Report the Examiners "treat the statutory mandate to ensure all utility facilities be 'safe, reasonable and adequate' as one requirement instead of three, allowing the three requirements to be balanced or traded off in a collective determination of compliance, thereby avoiding a determination about safety as a separate and independent requirement."

Further, Mr. Friedman states that the Examiners' Report improperly places the burden on the Complainants to prove that smart meters are harmful, rather than placing the burden on CMP to prove that the meters are safe. Mr. Friedman also accuses the Examiners of not adequately supporting their conclusions, relying on evidence lacking the indicia of reliability, disregarding and dismissing un rebutted record evidence, and misreading record evidence.

All of the above, according to Mr. Friedman leads to the conclusion that the Commission must ultimately decide that "CMP has failed to prove there is no credible threat of harm from its smart meter technology," and that "safety cannot be ensured without remedial measures."

C. Ms. Wilkins

Ms. Wilkins's position is that CMP's evidence fails to satisfy its burden of proof. Ms. Wilkins states that the consultants of both CMP and the OPA that measured the RF emissions are inexperienced and not qualified to test emissions from smart meters to determine FCC compliance. Moreover, Ms. Wilkins argues that compliance with the

FCC's exposure guidelines will not protect from the long term, non-thermal adverse biological effects because the FCC guidelines were only designed to protect from thermal heating effects from RF exposures and do not protect people from long-term, chronic, non-thermal exposures to RF. Specifically, Ms. Wilkins states that it is peak power RF exposure levels from the smart meters, and not the thirty minute, time averaged, power densities used by CMP's consultants, which measure the true impact to human tissue. Therefore, in Ms. Wilkins's view, CMP's exposure testing report is not relevant to determining if the AMI system is safe.

Ms. Wilkins argues that the evidence and testimony provided in this case by Mr. Friedman's witnesses and relevant additional support from the record shows there are many undeniable cumulative, adverse biological effects which subject the persons exposed, especially children, to an unnecessary and indefensible increased risk of serious adverse health effects. These include: cancer; DNA damage; damage to human sperm, reproduction and pregnancy; and damage to the Brain Blood Barrier.

In her April 8, 2014 exceptions to the Examiners' Report, Ms. Wilkins accused the Commission Staff of "undue influence and bias" in reaching their conclusions. Ms. Wilkins argues that the Staff was "under extreme pressure to somehow redeem themselves, save their jobs, and save their reputations" and so necessarily made the findings in the Examiners' Report. Ms. Wilkins also states that the Staff purposely, and wrongly, excluded relevant evidence, ignored other relevant evidence, and ignored relevant witnesses.

Other than her accusations of bias, Ms. Wilkins did not have any substantive comments or exceptions regarding the Examiners' Report.

D. Ms. Foley-Ferguson

Ms. Foley-Ferguson states that the wireless smart meter rollouts in the United States represent the largest proliferation of constant EMF ever initiated and the cumulative effects of EMF have never been determined to be "safe." Ms. Foley-Ferguson further states that, until recently, exposure to EMF emitting devices has been by "choice" not by force, and that people remain exposed even if they do not have a smart meter. Accordingly, Ms. Foley-Ferguson argues that CMP's AMI system is a forced and coerced exposure by the utility to a known environmental stressor and carcinogen.

Ms. Foley-Ferguson argues that, based on scientific studies, the Commission cannot determine that the health and safety of Maine residents are not jeopardized by the adoption of CMP's AMI system. Accordingly, Ms. Foley-Ferguson states that the Commission should recognize that there are adverse health effects from smart meter RF emissions.

Ms. Foley-Ferguson did not file comments or exceptions to the Examiners' Report.

E. OPA

The OPA's position is that the Commission may base a determination that the CMP smart meter network constitutes safe, reasonable, and adequate facilities and service upon a finding that the smart meter network is compliant with FCC regulations. In addition, the OPA argues that a finding based upon a national standard would be consistent with the Legislature's requirement that smart grid deployment be consistent with applicable standards for reliability, safety, security and privacy and that takes into account the implementation of smart grid functions in other jurisdictions." 35-A M.R.S. §. 3143(3).

The OPA notes that, pursuant to FCC's rules, smart meters are tested and evaluated in certified laboratories prior to sale to utility companies to ensure their compliance with the FCC's RF exposure limits. Such evaluations are documented in equipment certification reports provided by the manufacturer to the FCC. Moreover, the OPA states that the FCC standard or similar standards for safety have been used in other jurisdictions as a basis to determine that smart meters do not pose a health risk. Finally, the OPA states that his office commissioned a study (a) to measure the maximum and average power output of a sample of smart meters and other system components of CMP's AMI system, and (b) to assess whether the signal intensities from the components of the system were in compliance with the FCC regulations that prescribe limits for safe exposure of humans. The measurements taken for the OPA Study showed that even when combined with other RF signals occurring in an urban setting, the aggregate level of RF emissions was, on average, roughly 20 times lower than the FCC standards.

On April 11, 2014, the OPA filed a letter stating that the Office would not be filing exceptions to the Examiner's Report.

IX. DECISION

As discussed in the concurring opinions below, we find that AMI, including the use of smart meters, as implemented and operated by CMP, does not present a credible threat of harm to the health and safety of CMP's customers and, based on the record of this proceeding is, therefore, safe. The Commission through these concurring opinions finds that the AMI meters and network do not present a credible threat to the health and safety of CMP's customers and are therefore safe based on the network configurations illustrated in this record in use in Maine. The concurring opinions below take a slightly different approach regarding customers with medical treatment recommendations to avoid the AMI meters. Commissioner Littell would have CMP provide an AMI meter with transmitter off as part of the safety determination while Commissioner Vannoy would not impose the requirement. Both Commissioner Littell and Commissioner Vannoy concur that this difference in approach does not vitiate their concurrence regarding the safety of the AMI meters and network in use in Maine.

X. OPINION OF COMMISSIONER LITTELL

A. Overview

Based on the record as a whole, including all testimony, studies and reports, I conclude that the smart meters deployed by CMP are not a credible threat to the health and safety of CMP's customers based on our current best level of scientific understanding. In addition to a finding of safety, I would concurrently adopt the low-cost and limited precautionary measures described below that would further ensure safe and reasonable service to Complainants if medically advised to limit exposures to radio frequency radiation (RF/EMF).

The record is clear that there is some credible evidence that there may be health effects associated with significant exposures to RF/EMF, but credible evidence of possible effect does not demonstrate the Law Court's requisite credible threat of harm to CMP's customers nor an unsafe utility service. In this case, Complainants' and CMP's evidence serves to illustrate that there is scientific disagreement particularly on the risks posed by cell phones, cordless phones and other devices used close to the human body. There is credible scientific evidence to support multiple perspectives on safety of cellular (also called "mobile") and cordless phones. I caution against using terms like "majority" of studies, "overwhelming number" and "weight of the evidence" for two reasons: those characterizations are inaccurate as to this record, and more significantly science is not a majority or head-count endeavor: a well conducted study or small number of well conducted studies can show that all the science before it was based on incorrect hypotheses or inaccurate assumptions. With that in mind, this Commission is to evaluate and resolve this evidence consistent with the public interest under our long-standing statutory mandate to assure safe, reasonable and adequate service and facilities. 35-A M.R.S. §§ 101, 301.

Regarding the credible evidence, the World Health Organization (WHO) is charged with assessing cancer risks through its agency the International Agency for Research of Cancer (IARC). The WHO/IARC findings and other studies suggest there is a potential risk of tumors (in terms of glioma for cancer and neuroma for non-cancer tumors) from RF/EMF associated with cell phones, cordless phones and other personal devices. A subnational body like this Commission ignores a finding of potential effect by an authoritative international body at its peril. The WHO/IARC reclassification and research supporting that finding is credible.

However, this research and the WHO/IARC classification of RF/EMF as potentially carcinogenic focuses on exposures from cellular and cordless phones operated very near the body – often next to the ear and head – as opposed to smart meters installed on the outside of a building. For this reason, the cell phone exposure scenario is higher and different from exposures from a smart meter transmitter operated most often outside a building from the utility meter location. Due to distance and the presence of walls, RF/EMF exposure from AMI "smart meters" is typically two to four orders of magnitude below those of cell phones, cordless phones and other devices

used close to the human body. Thus, while the power levels and frequencies of RF/EMF as between smart meters and cellular phones are similar, the human exposure is markedly less from smart meters.

It is a basic principle of toxicology that the amount of exposure matters: measuring exposure and dosage often determines the level of safety. The lower exposure (and therefore risk) from smart meters on the outside of a house and repeaters on utility poles do not support a finding that the AMI meters are anything but safe based on the current science. I find the exposure levels from AMI meters to be safe given our current best level of scientific understanding of the credible risks posed by this technology. As discussed below, I would incorporate reasonable precautions for those with medical treatment recommendations to avoid such exposures.

B. Whether a Utility Service or Facility is Safe is an Appropriate Stand-Alone Inquiry

I agree with the Complainants that safe utility service is to be considered as a stand-alone standard. *Friedman Exceptions* at 3. This is consistent with the Law Court's ruling and the Commission's prior practice when, for instance, adequacy of service is questioned. The Law Court focused this Commission on the question of whether "smart meter technology is not a credible threat to the health and safety of CMP's customers" in light of the governing statutory requirement of the provision of "safe, reasonable and adequate service" in 35-A M.R.S. § 101. *Friedman*, 2012 ME 90, ¶10.

C. The Burden of Proof is on CMP

The burden of proof in this proceeding is on CMP. Complainants only need present enough evidence to initiate the investigation and complainants are not required to prove their case. *Hogan v. Hampden Tel. Co.*, 36 PUR 4th 485 (Me. PUC 1980); *MacMaster v. Gardiner Water Dist.*, 1998 Me. PUC Lexis 697 (Me. PUC 1998). The utility must prove its utility service is safe.

CMP must prove that the use of its smart meters – the Company's standard meter – is a safe utility service. The consistent use of "no clear and consistent evidence" and "no causal connection" in Exponent's reports is a veiled attempt to shift to the Complainants the burden of showing a definite causal link to human health impacts. This is a classic defense posture in a toxic tort case where the plaintiff carries the burden of proof. In this proceeding and under Maine law, once the complainants present enough evidence to initiate the investigation, the burden of proof concerning whether the utility is providing "safe, reasonable and adequate service" to customers then rests upon the utility. 35-A M.R.S. § 301.

However, it is also not reasonable to require CMP to prove a negative. Asking CMP to prove that the AMI meters pose no risk at all under an unlikely exposure scenario is not reasonable. Nor must the utility rebut every bit of evidence submitted in such a large case. *Central Maine Power Co. v. Pub. Utils. Comm'n*, 405 A.2d 153, 186

(1979) (even uncontradicted evidence may be weighed, critically examined and rejected). The determination of whether AMI meters are a safe utility service does not require the utility to investigate and rebut the health concerns of each customer. Such an examination might be invasive of these customers' privacy and it is not necessary in this case, particularly where over 9,000 CMP customers initially opted out and presently that number is roughly 8,000. The utility need not rebut every fact put in by complainants to carry its burden.

Thus, the production of *any* credible evidence that there is a possible risk does not mean that CMP's AMI meters are unsafe. Credible evidence of risk does not equate to a violation of CMP's obligation to provide safe electrical service nor to a credible threat of harm where that risk is neither likely to produce immediate nor imminent harm and is comparable to risks common in our society. There is always a risk that electrical service may cause a house fire when wiring is faulty or electrical service protections fail. The possibility of fire does not mean that the credible threat of fire poses an unreasonable safety situation arising from electrical utility service. In the context of providing electrical service, the risk of an electrical fire is mitigated through electrical codes and electrical system maintenance. Electrical codes are in fact a widespread and accepted precautionary mitigation measure to address the credible threat of electrical fires.

D. Safe Utility Practices Depend On the Purpose and Context of the Service and Facility as Well as Knowledge of the Effects and Alternatives to Fulfill the Same Service or Facility Function and Risk Mitigation

Safety in 1913, when the predecessor to Section 301 was included in the Commission's initial authorizing statute, meant regulating electrical service that could cause fires and electrocution. Later it came to also mean regulating natural gas that can cause explosions and fires. Later it came to mean regulating underground excavations where electrical, natural gas, telephone, cable and water services may result in the risk of loss of essential electrical, heat, communications and water service as well as the aforementioned fire, explosion, and electrocution risks.

In 1913, when these words were included in the Commission's mandate, the risks considered were primarily acute risks. The credible threats in 1913 were from a fire or electrocution from electrical service and flooding and water damage from water service. The threats of concern a century ago were of immediate bodily and property damage.

Scientific knowledge of risk, cultural norms, and societal expectations have changed. Accordingly, the Commission now considers certain chronic risks within its safe service and facilities mandate. For example, it is well-established – and has been for approximately forty years – that electrical and magnetic fields created by electrical lines pose an elevated threat of childhood leukemia. David O. Carpenter, *Human Health Effects of Nonionizing Electromagnetic Fields*, 6 *Patty's Toxicology* 113-114 (Eula Bingham & Barbara Cohrssen eds., 2012) (Carpenter, Health Effects of

Nonionizing EMF). The first study conducted in Denver, Colorado in 1979 showed that children living in proximity to power lines were more likely to develop childhood leukemia than children living in homes without elevated magnetic fields; this Denver study has been replicated with follow-up studies in Denver, Los Angeles, and Sweden all of which replicate the initial findings and substantial additional related studies. *Id.* Despite no biological mechanism identified and a lack of animal testing data, the WHO/IARC recognized that ELF is a potential carcinogen based on the strength of more than 30 positive epidemiological studies confirming the positive correlation between an increased risk of childhood leukemia and magnetic fields association with EMF. David Gee, *Late Lessons from Early Warnings: Towards realism and precaution with EMF?*, 16 *Pathophysiology* 217, 219 (2009); *International Agency for Research on Cancer*, Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields, Monograph Volume 102 (May 2011); *World Health Organization*, Extremely Low Frequency Fields Environmental Health Criteria Monograph No. 238, at 9 (2007). The threshold for elevated risk from these studies is uncertain as is the biological mechanism(s) through which the increased incidence of childhood leukemia occurs. Gee at 219. While a threshold for safe exposure to EMF/ELF is not clear, it is clear that there is a consistent pattern of elevated risk of leukemia in children at magnetic field levels greater than 0.3 or 0.4 μ Tesla (3 or 4 milli-gaus). *Carpenter, Health Effects of Nonionizing EMF* at 114.

Thus, this Commission has, for years, regulated the EMF/ELF from high voltage transmission lines to ensure that those in the vicinity of these lines are protected by keeping exposures well below 0.3 or 0.4 μ Tesla (3 or 4 milli-gaus).²⁴ See also *Maine Public Utilities Commission, Report Related to LD 950, An Act to Establish the Electromagnetic Field Safety Act on Setback Requirements Associated with Transmission Lines*, Docket No. 2013-00402, Report at 6-7 (Nov. 30, 2013) (MPUC Report). In its Report, the Commission summarized a report issued by the WHO in 2007 which concluded, based on an extensive review of research on the health effects of extremely low frequency fields,²⁵ that consistent epidemiological evidence suggests that chronic low-intensity ELF magnetic field exposure is associated with an increased risk of childhood leukemia.²⁶ *MPUC Report* at 6. To be clear, I discuss the Maine PUC

²⁴ The Commission examines health impacts of transmission line siting as part of Certificate of Public Convenience and Necessity (CPCN) proceedings. Section 3132 of Title 35-A requires the Commission to consider public health and safety in determining public need for a proposed transmission line as well as the proximity of the proposed transmission line to inhabited dwellings.

²⁵ *WHO*, Extremely Low Frequency Fields Environmental Health Criteria Monograph no. 238 (2007) (WHO ELF Report).

²⁶ It is important to note that the WHO ELF Report also concludes that there is inadequate evidence of an association between ELF magnetic field exposure and other childhood cancers, nor with any adult cancers including leukemia, nor with any other

Report not as an essential part of the reasoning or predicate for my decision but to illustrate recent actions at the Commission for handling similar concerns.²⁷ While the Commission is not strictly bound by precedent, it strives to reach consistent decisions and to reason by precedent much as a court does.

As more fully discussed below, the WHO ELF Report recommends the use of precautionary approaches for EMF, but cautions that

it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection.²⁸

diseases or disorders. *WHO ELF Report* at 9-10, 357. And even for childhood leukemia, the WHO ELF Report states that

virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.

Id. at 12. Thus, the Maine PUC Report does not recommend exposure limits based upon the epidemiological evidence alone, but does say precautionary measures could be warranted. *Id.* at 357.

²⁷ My opinion and recommendations are consistent with the Commission's EMF/ELF approach taken in these other Commission cases regarding EMF/ELF and summarized in the Maine PUC Report to the Legislature.

²⁸ The WHO ELF Report further states:

[o]nly the acute effects have been established and there are two international exposure limit guidelines (ICNIRP, 1998a; IEEE, 2002) designed to protect against these effects. As well as these established acute effects, there are uncertainties about chronic effects because of the limited evidence for a link between exposure to ELF magnetic fields and childhood leukemia. Therefore the use of precautionary approaches is warranted.

WHO ELF Report at 12.

WHO ELF Report at 12.

Thus, the costs of precautionary measures should be kept very low because benefits are hard to measure based on the weakness of the evidence of a link between exposure to ELF magnetic fields and childhood leukemia, and the difficulty in measuring impact on public health of such mitigation. *Id.*; *Maine PUC Report* at 8.

In 2010, in granting a CPCN for the Maine Power Reliability Program (MPRP), the Commission approved a stipulation that among other things set forth the following requirement addressing the safety of the MPRP project: "CMP will take all reasonable steps to mitigate EMF consistent with World Health Organization recommendations, including "reverse phasing" wherever practical." MPRP Stipulation at § V(E)(9), appended to *Central Maine Power Co. and Public Service of New Hampshire, Request for Certificate of Public Convenience and Necessity for the Maine Power Reliability Program Consisting of the Construction of Approximately 350 Miles of 345 kV and 115 kV Transmission Lines* (MPRP), Docket No. 2008-255, Order Approving Stipulation (June 10, 2010) (MPRP Order). The WHO recommendations suggest that governmental authorities mitigate high levels of EMF, particularly where low or no cost mitigation can be achieved.²⁹ Accordingly, this Commission, in cases involving MPRP landowner disputes regarding possible increased EMF exposure, required measurements of the EMF fields under different transmission configurations and examined whether the proposed EMF mitigation was low cost or no cost and whether it would materially reduce EMF levels. *Central Maine Power Company, Appeal of LDRT Decision Regarding Wanda and Mark Curtis*, Docket No. 2011-00504, Order (April 18, 2012) (Curtis Order); *Central Maine Power Company, Appeal of LDRT Decision Regarding Mary and David Fournier*, Docket No. 2011-00485, Order (April 30, 2012) (Fournier Order).

Consistent with the Commission's approach in the MPRP, the Curtis case, and the Fournier cases, the context and purpose of the service and facility require consideration. The type of utility facility or service defines the parameters of safety concerns. If there is a potential safety threat then the nature of the threat, the concentrations and strength of exposure, and the availability of alternatives and mitigation techniques are important in determining the safety of the utility service and facilities.

E. A Credible Threat to Human Health and Safety Does Not Mean Any Credible Evidence of Risk is Sufficient to Create a Credible Threat

The Law Court specifically charged the Commission with examining whether smart meter technology is a credible threat to the health and safety of CMP's customers. A credible threat to health and safety does not mean that *any* credible evidence of a risk or possible risk is sufficient to create a credible threat. If any credible evidence were to present a credible threat without considering the context, purpose and

²⁹ See *WHO ELF Report* at 13.

safety measures put in place, electrical service itself as well as natural gas and water service could pose a credible threat of harm. Credible synonyms include likely, probable, presumptive. *Merriam-Webster.com* (2014) (available at <http://www.merriam-webster.com/dictionary/credible>). Likewise, credible threat means a threat that is convincing; capable of persuading people that something will happen. *Oxford English Dictionary* (2014) (available at http://www.oxforddictionaries.com/us/definition/american_english/credible). It is one thing to make a finding that evidence is credible regarding potential harm and quite another to find there is a legally credible threat of harm – that a credible threat of harm is in fact credible: likely and probable to result in harm. Thus, the Law Court has ordered this Commission to determine whether CMP's smart meters are a likely and probable threat to its customers.³⁰

In a different legal context of examining what Article III standing requires for an injury-in-fact to be satisfied, the United States Court of Appeal for the Ninth Circuit considered how increased risk of harm and credible threat interplay. In a data breach case, *Krottner v. Starbucks Corporation*, 628 F.3d 1139 (9th Cir. 2010), the Court stated that

[a]lthough we have not previously determined whether an increased risk of identity theft constitutes an injury-in-fact, we have addressed future harm in other contexts, holding that "the possibility of future injury may be sufficient to confer standing on plaintiffs; threatened injury constitutes 'injury in fact.'" *Cent. Delta Water Agency*, 306 F.3d at 947. More specifically, [a] plaintiff may allege a future injury in order to comply with [the injury-in-fact] requirement, but only if he or she "is *immediately* in danger of sustaining some *direct* injury as the result of the challenged . . . conduct and the injury or threat of injury is both real and immediate, not conjectural or hypothetical." *Scott v. Pasadena Unified Sch. Dist.*, 306 F.3d 646, 656 (9th Cir.2002) (emphasis in *Scott*) (quoting *City of Los Angeles v. Lyons*, 461 U.S. 95, 102, 103 S.Ct. 1660, 75 L.Ed.2d 675 (1983)). Thus, in the context of environmental claims, a plaintiff may challenge governmental action that creates "a credible threat of harm" before the potential harm, or even a statutory violation, has

³⁰ None of the parties have pointed the Commission to any Maine Supreme Court precedent defining "credible threat" of harm. However, in a case involving a protection from abuse order and what was meant in a statute that speaks in terms of whether a defendant represents a credible threat to the physical safety of the plaintiff or minor child (19-A M.R.S. § 4007(1)), *L'Heureux v Michaud*, 2007 ME 149, 938 A.2d 801, the Law Court held that Section 4007 "does *not* state that a protection order can be issued based on a credible threat finding alone, nor does it define a 'credible threat.'" *Id.* ¶8 (emphasis in original). The Court concluded that credible threat language was meant to refer to federal firearms provisions, and to support "a firearms prohibition provision in an order based on a finding of abuse, or to which the parties have agreed." *Id.* ¶10.

occurred. See *Cent. Delta Walter Agency*, 306 F.3d at 948-50.

Id. at 1149.

The *Krottner* court then held:

If a plaintiff faces "a credible threat of harm," *Cent. Delta Walter Agency*, 306 F.3d at 950, and that harm is "both real and immediate, not conjectural or hypothetical," Lyons, 461 U.S. at 102 (internal quotation marks omitted), the plaintiff has met the injury-in-fact requirement for standing under Article III. Here, Plaintiffs-Appellants have alleged a credible threat of real and immediate harm stemming from the theft of a laptop containing their unencrypted personal data.

...

Were Plaintiffs-Appellants' allegations more conjectural or hypothetical—for example, if no laptop had been stolen, and Plaintiffs had sued based on the risk that it would be stolen at some point in the future—we would find the threat far less credible. On these facts, however, Plaintiffs-Appellants have sufficiently alleged an injury-in-fact for purposes of Article III standing.

Id. at 1143.

This 9th Circuit case addressed an entirely different threat – threat of identity theft. It nonetheless illustrates an analysis that increased risk of harm alone is not enough to constitute a credible threat of harm if not bounded in facts that are more than conjectural and hypothetical.

The statutory mandate to ensure provision of safe utility service and facilities means the Commission must limit risks to those that are reasonable considering the purpose, context and reasonable risk mitigation measures that can be implemented consistent with the provision of a utility service and facility. It is conceivable that the risk of a specific utility service or facility may outweigh its usefulness as we learn more about those risks and benefits. Such is the case with electrical transformers and equipment containing polychlorinated biphenyl ethers (PCBs), which performed very well as electrical equipment as an insulating liquid, but have been recognized over many decades to impose significant public health and environmental costs when the PCBs are leaked, released or spilled during maintenance. Due to widespread use, PCBs have been found in remote, seemingly pristine parts of the world such as the Arctic, and in the human food chain through animal feed and meat destined for human consumption. PCBs are now banned in new electrical equipment and existing

equipment is being phased out of service. The case of PCBs is illustrative because it shows how a seeming innovation of the early 20th century (use of PCB oil to replace more flammable electrical insulator oil) later became recognized as posing a credible threat to the public and, indeed, an unreasonable risk

F. The Commission is Mandated to Ensure the Safe Provision of Utility Service

A safe utility practice standard should limit both short-term (acute) and long-term (chronic) risks to those risks that are reasonable in light of the context and purpose of the service and facility. Regulators should also consider the magnitude of the risk (the concentrations and strength of exposure), the probability of harm (certainty based on science, engineering and medical knowledge), and the availability of alternatives to the service or facility and mitigation techniques to reduce the magnitude and likelihood of possible harm. The utility and Commission need to consider a broad range of reasonable operational scenarios and exposure scenarios that will be experienced in considering what utility practices are safe and what risk mitigation is required to meet the safety mandate. These standards of safety may change with time – indeed almost certainly will change – as technologies and scientific understanding advances.

I note my disagreement with both Mr. Friedman's and CMP's contentions on safety. Mr. Friedman defines safety as requiring "a place that is free of harm or danger." *Friedman Brief* at 6. The provision of electricity, gas and water service involve inherent risks. That is in fact why safety is in the Commission's mandate: to ensure there is a limit to reasonable risks and ensure safe utility service and facilities. CMP argues the Commission's mandate of safety in this case is limited to 35-A M.R.S. § 3143, An Act to Create a Smart Grid Policy in Maine, which concerns grid safety. *CMP Brief* at 1-2. Safety of the grid as addressed in that statute is a different matter from safety of the customers. CMP's argument that the Legislature limited Commission authority over safety in this provision is directly contrary to the Law Court's ruling in this case and is not well taken. The Commission has a clear mandate to ensure the provision of safe utility service and facilities.

The use of smart meter technologies is now becoming a common utility practice as indicated by the evidence in this case. However, it is not yet a standard utility practice outside Maine. Any suggestion that the use of smart meter technology is a standard utility practice in Maine because the Commission has approved for deployment to most utility customers, and thus a safe practice because it is a standard practice, is a tautology of little worth, especially in light of the Law Court's remand.³¹

³¹ I agree with Mr. Friedman that neither the promotion of state and federal energy policies nor consistency with generally accepted utility practices is an appropriate consideration. *Friedman Exceptions* at 4-5. Consistency at the federal policy level with general support for such infrastructure and observing that many other utilities are installing similar types of meters takes too broad a brush to determine whether a particular smart grid technology or practice is safe under the Law Court's decision.

The question presented by the Complainants is whether the Commission's approval was appropriately granted.

The Commission is primarily an economic regulator. Other state agencies have public health and environmental protection mandates as their primary mandate. Nonetheless, the safety of utility service is clearly within the Commission statutory mandate under Sections 101 and 301. There is a public and societal expectation that the Commission will ensure public safety in projects and facilities that come before us. In *Friedman*, the Law Court found that the Commission had erred in not addressing the safety of the AML installations.

While the Commission is primarily an economic regulator, too much has been made in Commission Orders and the Examiners' Report of the lack of Commission expertise on RF or public health issues. This Commission is in a similar position to the Federal Communications Commission (FCC) itself in setting these standards. The FCC does not claim an expertise as a *de facto* health agency and considers the views of federal health and safety institutes and agencies that address RF exposure. *In the Matter of Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies, et al.*, ET Docket No. 13-84, et al., First Report and Order Further Notice of Proposed Rule Making and Notice of Inquiry, FCC 13-39, ¶ 215 (Mar. 29, 2013) (FCC Notice of Inquiry). The FCC is guided by the expertise of federal safety, health and environmental agencies and institutes that perform regular reviews of the scientific research subject to federal budgetary constraints. *Id.* Additionally, the Law Court stated that "the Commission is not precluded from considering the findings and conclusions of other state and federal agencies." *Friedman*, 2012 ME 90, ¶ 11 n.7.

In fact, the Commission, as discussed above, considers health effects from electro-magnetic emissions from high-voltage transmission or other electrical equipment which involves similar expertise and knowledge. While advanced degrees are helpful, regulators need not have PhDs in each area of specialized knowledge – such as medical, radio frequency, genotoxicity, engineering, law – to competently regulate in a specific area. By way of illustration, the Commission does not have sufficient engineering or design expertise to fully and safely design a natural gas distribution system but does have adequate staff expertise regarding natural gas distribution system safety components and standards. The Commission has a comparable duty to exercise and develop the same level of expertise regarding safety of electricity service. There is a distinction between health effects expertise and institutional competence at the Commission to address general questions of safety. The Commission need not have medical and public health professionals on staff to make a thorough and judicious examination on the safe provision of utility service. In short, as the Law Court indicated, the Commission can weigh evidence and rely on other scientific, public health, governmental and institutional expert bodies' findings, assessments, and studies.

G. The Commission's jurisdiction of safe utility services and facilities is not preempted

The FCC's exposure standard does not preempt the Commission's authority. CMP raised the issue of federal preemption, but has generally not pressed the matter. While the issue was presented to the Law Court, the Court did not address the issue of federal preemption in its July 12, 2012 decision. CMP raised the matter through a Motion on the Scope of Proceeding at the outset of the proceeding on remand. CMP's argument was that the proceeding should be limited to whether CMP's smart meters comply with FCC regulations.

In its Order denying the motion on scope in the Opt-Out Investigation, the Commission noted prior precedent that, as a general matter, it is reluctant to find that it is preempted from carrying out the direction of the Maine Legislature. *Maine Yankee Atomic Power Company Re: Decommissioning Financing Plan*, Docket No. 82-179 at 17 (Feb. 22, 1990) (Commission will find preemption only in the most obvious of circumstances). With regard to considering the safety of smart meters, the Commission explicitly found that it was not preempted by federal law from considering the health and safety issues regarding CMP's smart meter program. The Commission stated:

Based on the submissions of CMP and the Intervenors, there is no direct federal preemption and novel field preemption issues require a thorough legal and factual analysis. CMP's arguments do not make this showing. It is certainly not obvious that the Commission's authority under 35-A M.R.S.A. § 101 is preempted from conducting this proceeding on whether CMP's smart meter service is safe.

Order Denying Motion at 2.

The Commission also stated that the issue of whether it must apply the FCC's RF emission standards to smart meters should be explored in the proceeding. *Id.* CMP has presented no compelling argument or evidence that the Commission is limited to applying the FCC's RF emission standard or that the Commission is preempted from conducting this proceeding.

It is inconsistent with this Commission's precedent and prior rulings to now question whether there is support for preemption of the very safety mandate that has been in this Commission's mission for a century and forms part of the statutory basis of the Law Court's Order that the Commission consider the safety of the AMI meters and network. 35-A M.R.S. § 101. Additionally, the Maine Constitution states that all people are born with certain natural rights, which includes "pursuing and obtaining safety and happiness." Me. Const. art. I, § 1. I construe the Constitutional mandate similarly to the Commission's statutory mandate under 35-A M.R.S. §§ 101 and 301.

H. The FCC Guidelines may be valid but are out dated and should be reexamined

CMP's expert, Exponent, urges the Commission to adopt or follow the FCC's 1996 guidelines for RF exposure developed for cellular telephones. However, in an area of active scientific inquiry, the FCC's exposure standard established in 1996 is too outdated to rely upon. The FCC standard is somewhat consistent with the Institute of Electrical and Electronics Engineers' (IEEE) standard but less stringent than the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and Canadian standards by averaging peaks over a longer period. The FCC standard should be examined in light of the science that motivated the WHO/IARC to reclassify RF radiation and more than a decade of scientific studies. Moreover, the U.S. EPA indicated that the FCC guidelines are not set to protect from non-thermal effects.

In the 18 years since the FCC established its guidelines, the safety of RF radiation exposure has continued to be a significant area of scientific study with substantial research developments. The FCC standard does not take into account almost two decades of research. Quite notably, the FCC standard does not consider the growing body of research on potential non-thermal effects of RF radiation. This scientific research led to WHO/IARC reclassifying RF radiation as a possible carcinogen among other notable developments. The WHO/IARC reclassification of RF/EMF includes parts of the electromagnetic spectrum used by smart meters as well as Wi-Fi, radio and TV towers as well as wireless phones. *Hardell Test.* at 16 (citing email from Dr. Baan at IARC dated Aug. 29, 2011).

For this reason, the FCC's safety standard for RF radiation exposure is out of date. The public would benefit if the FCC were to examine whether its current standard is sufficiently protective for thermal and non-thermal effects on the human body in light of both substantial changes in public exposure and more than a decade of scientific examination of the potential consequences of that exposure. Exponential growth in use of cellular telephones and smart phones, cordless telephones, home and work-based Wi-Fi systems, and other wireless communications have made exposure to RF radiation synonymous with modern life in developed countries. RF radiation exposure in modern society is omnipresent. Our knowledge is advancing concomitantly with the significant rise in use of these devices in addition to older devices such as telephones, radios, pagers and other forms of RF radiations from large, high-powered base station transmitting towers.

The Complainants note that the FCC does not set a safe peak exposure level. That is an issue the FCC may find appropriate to further examine. Nor does the FCC set a maximum instantaneous peak emissions level other than the power of the device; the FCC views the relevant power levels as the "maximum time-averaged power that takes into account the burst nature of transmission."

Accordingly, I am encouraged that the FCC and other federal agencies are now moving to consider whether the FCC's standard as well as the U.S. Food and Drug Administration's (FDA) standards provide adequate protection. The FCC initiated a

Notice of Inquiry on March 27, 2013. *FCC Notice of Inquiry*, ¶ 251. In the Notice of Inquiry the FCC stated:

We continue to have confidence in the current exposure limits, and note that more recent international standards have a similar basis. At the same time, given the fact that much time has passed since the Commission last sought comment on exposure limits, as a matter of good government, we wish to develop a current record by opening a new docket with this Notice of Inquiry.

Id. ¶ 205.

The Notice of Inquiry also contained substantial technical background on the FCC's current standards that were set based on thermal-effects. For example, the FCC notes that some devices may fail to comply with its current exposure limit when worn on the body. *Id.* ¶ 251.

I am also encouraged by the research priority being given to a number of issues raised by the Complainants, the National Research Council of the National Academies of Science (NRC), and the WHO. For wireless communication devices, the NRC has identified research gaps, research needs, and priorities (high and low) for dosimetry and exposure, epidemiology, human laboratory studies, biological mechanics, and *in vivo* and *in vitro* studies to understand how to accurately characterize any risks as well as the potential magnitude of such risks. *National Research Council, Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communication Devices*, (2008). The WHO has set a number of research priorities for children who use cellphones or live near base stations or radio and TV towers, including epidemiological studies, animal studies, *in vitro* studies and dosimetry and exposure assessments – these WHO research priorities focus on both children and the higher exposures from cell phones and base stations. *WHO, Research Agenda for Radiofrequency Fields* (2010) (*available at* http://whqlibdoc.who.int/publications/2010/9789241599948_eng.pdf); *WHO, Electromagnetic Fields (EMF), Children's EMF Research Agenda* (*available at* <http://www.who.int/peh-emf/research/children/en/index4>). The NRC research priorities, and international research priorities will advance scientific and regulatory knowledge of the risks posed by various types, frequencies and strengths of RF radiation. Nonetheless, this Commission must decide this case based on the current status of the science.

ICNIRP and IEEE standards are more recent than the FCC's. Averaging time for ICNIRP is 6 minutes and IEEE is 30 minutes. *CMP Brief at 21*. It is significant that the IEEE standard roughly corresponds to the FCC's standard, while the ICNIRP is more stringent because it averages over a shorter time period giving less time to average out peak (or "burst") transmissions.

Because the FCC guidelines are similar to those in other jurisdictions and quite particularly similar to the ICNIRP and IEEE standards, the evidence of compliance with the FCC's standards as one of many lines of evidence and legal contention should be considered in the case. Were the FCC standard not outdated, it would be considered more authoritative as explained above. The FCC and other countries' exposure limits for the general public vary from 1 mW/cm² to as low as 0.01 mW/cm² is set forth in Table 1 on page 15 above. These are average exposure limits and generally do not address peak exposures.

It is notable that many governmental average exposure levels for RF/EMF are similar to those set by the ICNIRP. Despite testimony that all existing safety standards are inadequate, it is not necessary to establish a specific safety standard beyond those in effect in multiple other jurisdictions. See, e.g., *Kumar Test.* at 3. The standards adopted by ICNIRP and IEEE and other jurisdictions in addition to the FCC provide relevant evidence under which to consider the relative safety of AMI smart meters.

The FCC's Maximum Permissible Exposure (MPE) limits for devices such as smart meters follow pre-defined rules for use of the unlicensed spectrum. To meet these MPE levels, smart meters are tested, evaluated, and certified by laboratories for compliance with the FCC's requirements such as RF exposures. Manufacturer equipment certifications document these evaluations. The MPE applied for CMP's smart meters for the public is 10 watts per square meter (or 1 milliwatt per square centimeter (mW/cm²) averaged over 30 minutes. 47 C.F.R. § 1.1310; *Examiners' Report* at 23. I return to these FCC test results below in Section X(K).

I. AMI Meter RF exposures are far below other commonly used consumer devices

CMP's evidence, taken together with the entire record, establishes that AMI meters currently and generally operate within a range of exposures that are lower than those to which members of the public are commonly exposed to in private and business environments. In fact, exposures are much lower than those from wireless cellular telephone exposure, of similar frequency and power levels. The primary difference is that cellular telephones are operated much closer to the human body within spaces such as homes, businesses and cars as well as nearly ubiquitously in public spaces. RF exposure is extensive in most homes and workplaces unless there is a specific effort to limit or eliminate RF. That does not prove it is safe, of course.

AMI meters operate on similar frequencies and power levels to cellular phones, cordless phones and Wi-Fi. Complainants and CMP agree on the basic lack of distinction between cellular phone and smart meter radiation in terms of quality and nature of radiation because cellular phones operate at similar although not identical frequencies within the electromagnetic spectrum as AMI meters. The relevant differences of exposure concern proximity to humans, the duration of use, and the extent of exposures, and not the basic physics of the RF emissions. Table 3 below

shows exposures from smart meters and other RF-emitting devices comparing exposure levels with what CMP experts call peak power at different distances:

TABLE 3
Residential RF/EMF Exposure Levels calculated on a Peak Basis

Technology	Peak Exposure (mW/cm²)	Peak Power (W)	Frequency
Smart meter, 1 yard distance - Outside	0.031	1	2.4 GHz
Smart meter, 1 yard distance - Inside	0.0015	1	2.4 GHz
Access point 2.4 GHz, 20 feet away horizontally, same height	0.00042	1	2.4 GHz
Cell phone next to head	1.5 – 12	0.125 - 1	450 MHz, 480 MHz, 850 MHz, 900 MHz, 1800 MHz, 1900 MHz
Cordless phone next to head	0.05 – 1.2	0.004 – 0.1	900 MHz, 1.9 GHz, 2.4 GHz
Microwave over (1 foot away), 1 minute heating every half hour	0.14	1.6	2.4 GHz

Information in Table 3 extracted from Joint Testimony of Linda S. Erdreich, Ph.D., William H. Bailey, Ph.D., & Yakov Shkolnikov, Ph.D., Docket 2011-00262 at 28-29 (November 16, 2010).

The exposure from cellular phones near the body and head exceed AMI meter exposure by two to four orders of magnitude, though higher exposures from other devices do not prove safety. These relative exposure levels do establish relative frames of reference and suggests that, if there is a credible safety threat related to RF exposure from AMI meters, those concerns would be amplified for RF exposures from cellular phones, mobile PDAs, cordless phones, home and office Wi-Fi and other devices.

J. Complainants present credible studies and witnesses that RF radiation may cause possible non-thermal effects

Complainants have produced well known and respected experts. This testimony is generally consistent with the WHO/IARC reclassification decision, though some of Mr Friedman's witnesses would go farther than the WHO/IARC has done. The WHO/IARC determination and reclassification presents persuasive evidence of a possible risk. The WHO/IARC is the definitive international scientific body charged by the United Nations to assess the cancer risk of chemicals and substances and to classify those chemicals

and substances according to the most current science available into cancer risk categories. Accordingly, the WHO/IARC reclassification is credible evidence of a possible risk from RF/EMF.

Dr. Lennart Hardell, a professor of oncology at Orebro University Hospital in Sweden, specializes in the epidemiological research of cancer risks related to exposure to toxins. He is a leading epidemiologist in the world on the subject of cancer risks associated with RF exposure from wireless phones. Dr. Hardell has been conducting research on environmental risk factors for cancer since the 1980s, has conducted research on disease risks associated with electromagnetic fields since the 1990s, and has published over 300 scientific articles in peer-reviewed journals, chapters in books and commentary. Dr. Hardell published an evaluation of cancer risks associated with exposure to extremely low frequency electromagnetic fields (ELF-EMF) in a peer-reviewed scientific journal in 1995, and he participated in and been the lead investigator and author of a large number of scientific studies on use of cellphones and cordless phones and the risk for certain malignant diseases (brain tumors, salivary gland tumors, testicular cancer, non-Hodgkin lymphoma, malignant melanoma). This has resulted in more than 80 publications on the subject. Dr. Hardell has also on numerous occasions been invited to participate in scientific meetings to present the results from his studies. In short, Dr. Hardell is a well-respected and highly regarded researcher in the field of low-level RF radiation. Dr. Hardell served as a member of the IARC Working Group in May of 2011. Based on the Working Group's exhaustive evaluation of the science, IARC issued its classification of RF as a possible human carcinogen. *Hardell Test.* at 1-2, and Exhibit. A.

In this proceeding, Dr. Hardell testified about the case control studies and meta-analyses performed by his research team. He also testified to his extensive knowledge of most of the peer-reviewed epidemiological studies that have been published since the 1990s and to his knowledge of laboratory studies showing genotoxic effects from low level RF exposures. *Hardell Hearing Test.* (Oct. 30, 2013). Dr. Hardell testified to his expert opinion and to evidence supporting a causal relationship between low-level RF exposure and forms of brain cancer. *Hardell Supp. Test* at 3 and Exhibit D; *Hardell Hearing Test. Oct. 30, 2013 Transcript* at 11, 21. For example, Dr. Hardell's research indicates a statistically significant increased risk for glioma per 100 hours of cumulative cell and cordless phone use. This is a statistical dose-response relationship. Data Request CMP-003-003.

Dr. Hardell believes the evidence is strong enough to make a causal linkage. He acknowledges that human exposures are much stronger from cellular phone usage than from smart meters. He nonetheless believes all sources of manmade RF should be reduced or eliminated based on his research.

Dr. Hardell's testimony is credible. His expertise is recognized by the international scientific community sufficiently to result in his appointment to the WHO/IARC committee evaluating RF for the international scientific community. However, it is important to note that WHO/IARC only partially accepted the view of causality of cancer in humans from RF radiation. The WHO/IARC committee on which

Dr. Hardell sits reclassified RF radiation as a possible – not a known – source of cancer. His research was persuasive enough along with much other work for the WHO/IARC to reclassify RF as a possible carcinogen but not as a known human carcinogen.

Dr. Darius Leszczynski also presented credible written testimony, particularly because he is careful to explain what the scientific research to date establishes and what it does not. Dr. Leszczynski, a member of the Working Group of the IARC/WHO that in May 2011 classified RF from cell phones as a possible carcinogen, is a research professor at the Radiation and Nuclear Safety Authority (radiation biology laboratory), Helsinki, Finland and adjunct professor of biochemistry at the University of Helsinki. Dr. Leszczynski and his research group have worked in the field of biological and health effects of cellular phone RF for the past 15 years, studying the biological and health effect of cellular phone RF using high-throughput screening techniques of proteomics to identify RF-affected proteins and genes. *Leszczynski Test.* at 2. Dr. Leszczynski has co-authored over 90 publications in peer-reviewed journals. *Id.* at 3.

Dr. Leszczynski testified to the Commission regarding the WHO/IARC's review of low-level RF/EMF for carcinogenicity by a group of 30 scientists selected from 14 countries. Dr. Leszczynski testified that RF was found to have "limited evidence in humans" of carcinogenicity and tumor-growth based on positive associations between glioma and acoustic neuroma³² from exposure to RF from wireless phones, particularly the results of the INTERPHONE study³³ and the Swedish Hardell group. *Leszczynski Test.* at 6-7. Dr. Leszczynski explains how IARC defines "limited evidence":

A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

Id. at 7.

Dr. Leszczynski noted that while some members of the WHO/IARC working group disagreed with RF/EMF being classified as a possible carcinogen, their opinion focused on a study known as the Danish Cohort study. Dr. Leszczynski found their concerns unconvincing due to the serious design flaws of the Danish Cohort study. The Danish Cohort study only used time with a cellular phone subscription as exposure data so a person who spoke on the phone 5 minutes a month and a person using the phone

³² Glioma is a cancer. Acoustic neuroma is a non-cancerous tumor.

³³ The INTERPHONE study, for example, reported a statistically significant increased risk of 179% for acoustic neuroma for 1,640 cumulative hours of use with 5 or more years of cellphone use. *Morgan Test.* at 15. There are other non-peer reviewed indicators of significant increase in brain cancer or non-cancer tumors in the record which are not peer reviewed and not generally accepted as reliable scientific and therefore not relied upon in this decision. *Id.* at 16-20.

many hours a day would have been put in the same exposure group. Secondly, all corporate subscribers were excluded, thereby potentially excluding the heaviest users and most exposed users from the Danish study. Third, the cut-off time for exposure was also flawed as Dr. Leszczynski explained: the Danish Cohort study set the cut off for year 1995 with analysis for cancer induction done based on 2007 cancer registry data. So a person who took a cellular phone subscription after 1995 was considered non-exposed by the study design. Thus a person who subscribed in 1996 and developed brain cancer in 2006 would be counted as non-exposed. *Id.* at 8-9. Dr. Leszczynski's concerns with the Danish Cohort study, which were also shared by the WHO/IARC group in finding that the Danish Cohort study had methodological issues, are well supported and well founded.³⁴ For these reasons, Dr. Leszczynski's testimony is well taken.

Mr. Friedman notes properly that Exponent largely ignores the WHO/IARC classification. The WHO/IARC classification is significant within the public health community for carcinogenicity. IARC evaluates agents and classifies them into different groups depending on their carcinogenicity. The IARC notes that "categorization of an agent is a matter of scientific judgment that reflects the strength of the evidence derived from studies in humans and in experimental animals and from mechanistic and other relevant data." World Health Organization, International Agency for Research on Cancer, *Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields*, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 102 at 30 (2013). IARC classified radiofrequency electromagnetic fields as a Group 2B carcinogen. Group 2B categorization is used for agents that are found to be possibly carcinogenic to humans. *Id.* The majority of the members of the IARC working group found that there is limited evidence in humans and experimental animals for the carcinogenicity of radiofrequency radiation. *Id.* at 419. As stated above, limited evidence of carcinogenicity in humans is when a positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by IARC to be credible, but chance, bias, or confounding could not be ruled out with reasonable confidence. *Id.* at 27. IARC is the authoritative international scientific body regarding classification of cancer risks so this classification carries great evidentiary weight. CMP's witnesses are unable to rebut the evidentiary value of the WHO/IARC evidence together with much of the testimony of Doctors Hardell and Leszczynski. See *Hardell Hearing Test.* (Oct. 30, 2013); *Hardell Test.*; *Leszczynski Test.*

However, the WHO/IARC classification is as a 2B potential carcinogen; it is not a WHO/IARC classification as a *known* carcinogen.³⁵ A causal relationship to RF

³⁴ I also note my general agreement with some of the concerns with the Advisory Group on Non-Ionizing Radiation (AGNIR) Report outlined in Dr. Leszczynski's testimony at 14-15.

³⁵ Known carcinogens are categorized as Group 1 carcinogens by the WHO/IARC when there is sufficient evidence of carcinogenicity in humans. *IARC Monograph Volume 102* at 29. Sometimes, though rarely, "an agent may be placed in this category when evidence of carcinogenicity in humans is less than sufficient but there is sufficient evidence of carcinogenicity in experimental animals and strong evidence in exposed

exposure has not been established. But that only means that the WHO/IARC has not classified RF as a known carcinogen and does not detract from the significance of the WHO/IARC 2B potential carcinogen classification. On the evidence in this case, there is scientific disagreement on whether RF should be classified as a known carcinogen. Drs. Hardell and Leszczynski believe so along with a number of Mr. Friedman's other witnesses, but the WHO/IARC does not go so far. Whether a substance is a known carcinogen or a 2B potential carcinogen, it may or may not pose a credible threat. The scientific classification as a known, potential, or non-carcinogen is not a *sine qua non* regarding whether a credible risk of harm exists. Context, exposure, usage and dose matter in making a credible risk of harm assessment.

Exponent's comparison to natural background and human body RF is not helpful. The natural RF characteristics are broadband ranging from 3 kHz to 300 GHz according to Exponent. In fact, the measurement devices used by Exponent in the field could not measure natural RF. *May 23, 2013 Tech. Conf. Tr.* at 36-37. Showing information on broadband and low levels of RF as naturally occurring is apparently intended to show that levels are somehow safe. But Exponent does not make the argument that naturally occurring levels are safe. Data Request Friedman-03-04 prepared by Exponent's Yakov Shkolnikov. Without making the argument that these natural levels are safe, this information is less than helpful. It is well known that a number of natural exposures ranging from sunlight to arsenic in drinking water and radon in buildings are both naturally occurring and pose human health risks. The information on low-level broadband natural RF presented here is not helpful.

Exponent's use of "weight of evidence" is particularly uninformative as it lacks scientific rigor and is non-transparent. This treatment of Dr. Shahin's studies is an example of how Exponent utilizes what it calls a "weight of the evidence" approach.³⁶

humans that the agent acts through a relevant mechanism of carcinogenicity." *Id.* at 29-30.

³⁶ Some recent studies by Dr. Shahin were introduced into the record that reported increases in oxidative stress in response to very low levels of RF, comparable to smart meter radiation. *Shahin et al.*, "2.45 GHz Microwave Irradiation-Induced Oxidative Stress Affects Implantation or Pregnancy in Mice, *Mus musculus*," *Appl Biochem Biotechnol* (pub. Online Jan. 22, 2013). Oxidative stress is studied because it can lead to genotoxicity (toxic reactions to genes). 2.45 GHz microwave irradiation-induced oxidative stress affects implantation or pregnancy in mice. *Id.* CMP argued that in applying a "weight of evidence" process, a 2009 review by the ICNIRP found there was insufficient evidence to conclude that low-level RF causes oxidative stress. *CMP Rebuttal Test.*, at 81-82. However, the recent studies by Shahin were conducted after the ICNIRP review and therefore, the 2009 ICNIRP could not have evaluated the Shahin studies. Shahin's research is in a line of recent scientific research advancing the body of knowledge of RF radiation. The efforts to discredit that research by Exponent through generalized weight of the evidence reference rather than addressing the substance of the study are not persuasive.

This "weight of the evidence" approach simply glosses over studies that an expert does not agree with rather than addressing the specifics of research or studies with rigor or explaining their own assumptions in any detail so it lacks transparency. It is particularly uninformative because Exponent then insists that Complainants' studies must address all uncertainties and provide complete explanations of the physical and biological mechanisms of causation tracing exposure to biological effect. This is an erroneous standard to force Complaints to "prove" that RF causes such harm, when by law and as previously discussed herein, it is CMP that has the burden of proof, not the Complainants.

Of course, even the same types of studies, animal studies for example, may not all be consistent. Results for animal tests can vary with slightly different study designs. Biological systems are complex and different study designs will yield different results; difficulties replicating studies are to be expected. As researchers vary those designs and attempt to replicate each other's' studies, more knowledge evolves. Different types of studies, animal studies and epidemiological studies tracking large human populations over time may show different results and that is not surprising either, as some biological mechanisms in lab rats are different than people and epidemiological studies cannot control for as many variables as laboratory research is able to. On the other hand, laboratory experiments are incapable of seeing population level effects. Further, laboratory experiments are severely limited by ethical requirements on conducting research on human subjects. Nonetheless, better research over time using different study methods will determine a higher level of certainty on questions of biological effects from likely higher levels of RF.

With a recognition that there is some credible evidence of potential harm, the next logical question is how to evaluate that risk of harm to determine if the risk of potential harm is being adequately managed to be "safe," and therefore, not a credible threat, *i.e.*, likely to cause damage or danger. What framework is appropriate to consider whether the risk is being adequately managed? In an article in the record, David Gee of the European Environmental Agency presents a framework to consider the difficulty measuring effects in complex biological systems that may result from forms of EMF, including multi-causality, thresholds, timing of dose, sensitive sub-populations, the sex, age, genetics and immune status of the host and cumulative exposures to EMF and other stressors, non-linear dose-response relationships, low dose effects, and the absence of entirely unexposed controls. David Gee, *Late Lessons from Early Warnings: Towards realism and precaution with EMF?*, 16 *Pathophysiology* (2009). Mr. Gee warns in particular of ignoring positive real world observations of biological effects, consistent with two of Hill's criteria (discussed below), on the basis of biological mechanisms for those effects not being understood:

In the context of expanding scientific knowledge, the "implausibility" of biological interactions may not be a robust basis on which to dismiss positive epidemiological or experimental observations, especially when the biological models being used are "simplistic."

Id. at 219. In simple language, Gee's framework suggests that, when we have indications of concern without the full knowledge base we would prefer to make decisions regarding safety, we ought not to dismiss such concerns easily or based on overly simplistic rationales.

When evidence of harm is neither definitely positive nor negative, consideration of the Hill criteria is important in assessing whether a particular agent may cause a particular effect. The Hill Criteria, first articulated in an address at the British Royal Society of Medicine by Austin Bradford Hill in 1965 and later published in the *Proceedings of the Royal Society of Medicine*, are well known and generally accepted as a useful framework in toxicology to assess unclear evidence of harm. The Hill Criteria consist of nine criteria that provide a framework for assessing whether there is adequate evidence of a causal relationship between an incidence and a consequence. The Hill Criteria are generally used in epidemiological studies to test whether a particular agent is the cause of a selected effect when it is difficult to control for all experimental variables (meaning that causative agents must be inferred from observational data). The Hill criteria include factors such as strength (how large is the effect?), consistency (has the same association been observed in others, in different populations, using a different method?), and biological gradient (is there a dose response?).

Dr. Hardell recommended using the Hill Criteria in his initial testimony. Dr. Hardell states on page 9 of his testimony, "Using the Hill criteria on use of wireless phones and brain tumor risk infers causation of the association found in epidemiological studies. Most of these criteria are fulfilled". In CMP's rebuttal testimony, the Company critiqued Dr. Hardell's application of the Hill Criteria as follows:

Q: Do the references made in the testimony of Drs. Hardell, Conrad, Leszczynski, and Mr. Morgan to Sir Bradford Hill's criteria for consideration of epidemiology studies constitute a scientific methodology?

A: No, alluding to Hill's criteria without providing a supporting review of the scientific evidence according to Hill's criteria does not constitute an adequate weight of evidence assessment. A similar failure to follow Hill's criteria to establish claims for health effects was mentioned in the 2012 Exponent Testimony.

CMP Rebuttal Test. at 24.

In his supplemental testimony, Hardell included a paper he co-authored (Exhibit D to Dr. Hardell's Supplemental Testimony) in which he specifically applied the Hill Criteria to cellular phones. Lennart Hardell and Michael Carlberg, *Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors*

associated with use of mobile and cordless phones, De Gruyter – Rev Environ. Health (2013) (*Hardell and Carlberg*). Dr. Hardell states that his paper directly supports his "opinion that a causal association between low-level RF radiation and adverse health effects can be inferred from the science and that exposure to low-level RF radiation, including at levels and frequencies transmitted by smart meters, poses risks to human health." *Hardell Supp. Test.* at 4. On page 3 of his supplemental testimony, Dr. Hardell also states:

All nine issues on causation according to Hill were evaluated to assess the causal association between long-term wireless phone use and brain tumours, specifically acoustic neuroma and glioma. Epidemiological studies of long-term use and laboratory studies and data on the incidence of brain tumors were considered. We concluded that based on the Hill criteria glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones, which should be regarded as carcinogenic to humans.

The Hardell paper applies the Hill Criteria and concludes that that the criteria are met with regard to cellular phones. CMP's critique of Complainants' use of the Hill Criteria relies on Lawrence Berkeley National Laboratory's (LBNL) application of the Hill Criteria along with arguing that some of Dr. Hardell's findings are directly inconsistent with the Hill Criteria. *CMP Rebuttal Test.* at 87-88. Dr. Hardell's application of the Hill Criteria goes significantly beyond Exponent's view that it is an "allusion to Hill's criteria." It is a significant and plausible application of the Hill criteria to use of wireless phones. Dr. Hardell particularly describes the increased exposure to the human brain from cell phones and cordless phones, ". . . especially to the temporal lobe on the same side where the phone is used, i.e. ipsilateral exposure." *Hardell and Carlberg* at 2. The study notes the Danish cohort study was evaluated as inconclusive due to methodological issues. *Id.* The paper then proceeds to carefully apply the Hill criteria and reach its conclusion that "glioma and acoustic neuroma are caused by RF-EMF from wireless phones." *Id.* at 9. This conclusion is supported by exposure groups involving cumulative use of cellular phones by two different studies. *Id.* at 8.

However, LBNL applied the criteria to both cellular phones and smart meters and found that, "based on our judgment, the Hill's criteria have not been satisfied for smart meters, regardless of how well they may or may not be satisfied for cell phones." *Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory, "Review of the April 12, 2012 American Academy of Environmental Medicine (AAEM) submittal to the Michigan Public Service Commission" (April 18, 2012) at 3 (Levy and Page).*³⁷ The LBNL review relies heavily on the lack of published, peer-reviewed scientific research meeting the nine Hill Criteria for smart meters and

³⁷ "This is due to significant technical differences between cell phones and smart meters and the absence of research that specifically addresses smart meter operating characteristics." *Levy and Page* at 3.

compares that to the similarly "limited evidence" and "limited coherence" of "some studies" for evaluation of RF exposure from cellular phones. *Id.* at 2. LBNL opines that "it is inappropriate to presume an effect when the sources differ in terms of their frequency, intensity, proximity to critical biological tissues, etc." *Id.* The LBNL memo concludes that "based on our judgment, the Hill's criteria have not been satisfied for smart meters, regardless of how well they may or may not be satisfied for cell phones." *Id.* at 3. It is notable that LBNL limited its opinion that the Hill Criteria are not satisfied by RF from smart meters, which highlights that there may or may not be a stronger case for cellular phone exposures causing harm, but in any case differentiates the possible effects from smart meters and cellular phones.

Based on this analysis, the LBNL and Hardell conclusions from application of the Hill Criteria actually are not inconsistent. Dr. Hardell finds no increased risk for brain tumors in subjects using the cellular phones in a car with an external antenna. *Hardell and Carlberg* at 1. In assessing the experimental criteria, Drs. Hardell and Carlberg assess the data on use in cars with external antenna and hands-free devices as follows:

However, especially in the 1980s, mobile phone use was common in cars, with fixed external antenna as the only mode of use. Such use has been assessed in the Hardell group studies and considered to be no exposure to RF-EMF. For the study period 1 January 1997-30 June 2000, among 1429 responding cases and 1470 controls, 73 cases and 90 controls had always used the mobile phone with fixed external antenna and 1 additional control had always used a hands-free device. This yield crude OR=0.8; 95% CI=0.6-1.1. Thus, this "experiment" showed that if the RF-EMF exposure from the mobile phone was protected, no increased risk was found.

Id. at 7.

In sum, when the antenna is not immediately next to the head, this assessment suggests that the data does not support the finding that there is increased risk of brain tumors. This supports the LBNL review of the Hill Criteria related to smart meters as presenting a different RF/EMF exposure that may in fact result in "no increased risk found," to borrow Doctors Hardell's and Carlberg's terminology.

CMP's own evidence tends to confirm that there is some risk from RF. A Dutch study by the Health Council of the Netherlands submitted by CMP reviews three other studies and concludes that "there are some weak and inconsistent indications for an association between prolonged and intensive use of a cellphone an increased incidence of gliomas." Health Council of the Netherlands, *Mobile phones and cancer* (June 3, 2013) at 34. But this review, which is not a study but a review only, finds evidence of acoustic neuroma from cellular phone use to be "inconsistent and do not really give an indication of an increased risk." *Id.* at 35. It concludes that there is no "clear and

consistent evidence for an increased risk for tumours in the brain" *Id.* at 35. This study and review is not especially informative or reliable but it illustrates that the argument is over the degree of risk. The existence of some risk is acknowledged in the utility's own evidence that show there is no dispute regarding whether there is any scientific evidence of a risk from RF. This question is whether the existing science suggests levels from smart meters are high enough to pose a credible risk of harm. The WHO/IARC reclassification and Dr. Hardell's and Dr. Leszczynski's testimony is more reliable and credible given the recognition in the scientific community, careful scientific approach and explanation of these sources and experts, along with IARC/WHO's status as the authoritative international authority on classifications for these purposes.

Moreover single-hit versus multiple hit or continuous exposure theory is well known in carcinogenesis. *Data Request CMP-003-012*. While there is support for the single-hit theory in more recent research, this is not something this Commission need resolve with respect to RF nor whether there is a threshold for cancer risk or not, or a level for cumulative or incremental exposures. *Friedman Brief* at 69-71; *Friedman Exceptions* at 7. Suffice it to say there is credible evidence to support a no safe threshold opinion as well as Exponent's view that there is a level below which effects cannot be detected. I would expect the scientific examination of this issue by experts and Laboratories to continue. This record is not sufficient to determine thresholds for cancer risk or levels of cumulative or incremental exposures particularly in a developing area of scientific inquiry and I decline to do so.

The record is sufficient to conclude that emissions of RF/EMF from smart meters, at the power levels and frequencies that are comparable to cellular phones but at a greater distance from the human body and most often separated by a structure, pose a lowered level of exposure and therefore lower risk than cellular phone and cordless phone exposures by three to four orders of magnitude and therefore are not a credible threat to health and safety.

K. Actual Testing of the Meters by Trilliant and Field Measurement Indicate RF Levels are Below all Governmental and International Standards and Well Below Other Forms of RF

Dr. Hardell cites an email from Dr. Baan with the email as an exhibit to his direct testimony. *Hardell Test.* at 16 (citing email from Dr. Baan of IARC dated Aug. 29, 2011). In answering an inquiry on the WHO/IARC reclassification, Dr. Baan states that the reclassification applies to the entire spectrum of RF/EMF including smart meters. Dr. Baan then includes a significant statement: "An important point is the radiation level. The exposure from cellular phones (personal exposure) is substantially higher and much more focused (usually on the brain) than exposures from radio/tv towers, antennas or Wi-Fi." *Id.* Dr. Baan's statement alludes to a principle of toxicology: the dose makes the poison – the concentration of exposure matters.

Devices emitting RF must be tested by the manufacturer to qualify for an FCC authorization. The manufacturer of CMP's smart meters, Trilliant, had the meters tested

to qualify for the FCC process for Grant of Equipment Authorization. This initial manufacturer testing of the meters requires dosage measurements of radiated power/radiation. This equipment testing showed FCC compliance even at 20 cm from the meter – an unrealistically high exposure scenario. At 3 feet, the peak signal strength would be two orders of magnitude below the FCC³⁸ and ICNIRP standard of 1.0 mW/cm². *Id.* At 3 feet, the average exposure would be five orders of magnitude (roughly 100,000 times) lower than the FCC and ICNIRP standard. Since most exposures would occur from a meter outside with an external wall and meter banking in between, there is an additional margin of safety as well from the barriers presented by the structure and meter backing, both of which reduce RF field strength. Even allowing for the outdated FCC standard and WHO/IARC reclassification, these measurements indicate a reasonable margin of safety for the vast majority of exposures from smart meters.

Moreover, actual field tests of the CMP AMI meters and other smart meters suggest RF exposures from smart meters are less than those from cellular phones and therefore exhibit a substantial margin of safety. The OPA conducted field tests of three smart meter sites plus two repeater sites. OPA's study would have picked up all sources of RF radiation. At one site with three smart meter banks, the OPA's consultant found an RF level of 13.4% of the FCC maximum exposure limit for the general population. Exponent conducted field testing of three smart meter sites which could not detect any RF. Notably, the OPA's measure is only one order of magnitude below the FCC limit rather than two to three orders of magnitude predicted by CMP's experts. This is likely attributable to multiple meters and other sources of RF, but this does point to the importance of fully assessing the impacts of large installations of meters.

Mr. Friedman rightly points out that these studies are far from perfect. Sites were selected to find maximum and lesser exposures rather than selected using a statistical sampling technique. There was no confirmation of meter transmission operating when testing occurred and peak active period may have been missed because OPA's consultants only measured a portion of the meters most active transmission period. Thus, worst case measurements were not made nor were peaks necessarily measured. For these reasons, the field tests are not definitive but they do nonetheless tend to confirm the initial equipment testing and calculations on exposure levels are not wildly off base.

Two additional field tests were conducted by the Vermont Department of Health and the Electrical Power Research Institute (EPRI). While these tests were on different meters operating at different power levels and frequencies, the results also tend to confirm that actual exposures are below all current governmental and international exposure standards. The EPRI study was done using careful scientific methods to look

³⁸ While I prefer to reference the more recent ICNIRP standard than the FCC, virtually all of the CMP's expert testimony by Exponent was presented in terms of the FCC standard. Staff spent considerable time looking at underlying data and the manufacturer testing to assess the underlying data on potential exposures.

at exposures from 7,000 smart meters located in a 20 acre area, so a dense meter configuration, and confirmed a finding of compliance with the FCC standard. The dense meter configuration tested by EPRI produced exposures higher than those shown in the Maine testing. The Vermont study also confirmed compliance with FCC limits.

Moreover, AMI meters generally, based on this record, comply with regulations in numerous other jurisdictions that are more up to date than the U.S., including the EU and 23 other countries. See Table 1 above. The British Columbia Utilities Commission explicitly reviewed the safety issues relating to thermal and non-thermal effects and approved a deployment of AMI meters last year. B.C. Utilities Commission, *In the Matter of FortisBC Inc.*, Decision relating to Certificate of Public Convenience and Necessity for the Advanced Metering Infrastructure Project (July 23, 2013).

The California Council on Science and Technology (CCST) found that AMI meters result in smaller levels of radio frequency exposure than many common household devices, such as cellular phones and microwave ovens. *California Council on Science and Technology*, Final Report, "Health Impacts of Radiofrequency Exposure from Smart Meters" at 1 (Apr. 2011). Additionally, the CCST found that to date, scientific studies have not identified negative health effects from potential non-thermal impacts of RF emissions such as those produced by smart meters. *Id.* at 4. Therefore, CCST found that not enough is currently known about potential non-thermal impacts of RF emissions to identify or recommend any additional standards beyond the FCC standards. *Id.* at 5.

The Maine Center for Disease Control (Maine CDC) issued a report on November 8, 2011, regarding health issues related to smart meters. *Maine CDC*, "Maine CDC Executive Summary of Review of Health Issues Related to Smart Meters" (Nov. 8, 2010) (Maine CDC Report). The report concluded "that studies to date give no consistent or convincing evidence of a causal relation between RF exposure in the range of frequencies and power used by smart meters and adverse health effects." *Maine CDC Report* at 3. The Maine CDC did not make a safety finding.

In June 2012, the National Cancer Institute (NCI) updated its information about cellular phones and concluded that although there have been concerns regarding radiofrequency energy from cellular phones and how it may affect the brain and other tissues, "to date there is no evidence from studies of cells, animals, or humans that radiofrequency energy can cause cancer." *NCI*, Cell Phones and Cancer Risk (June 18, 2012) (*available at* <http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones>). This finding is consistent with the WHO/IARC reclassification which found the reclassification justified in part on epidemiology studies in addition to studies of cells, animals or human. The NCI also reviewed what other expert agencies have concluded regarding cell phone and cancer. The NCI notes that the FDA has also stated that while some studies have reported biological changes associated with radiofrequency energy, these studies have failed to be replicated. Additionally, the FDA has stated that the majority of published studies have failed to show a relationship between exposure to radiofrequency energy from cell phones and health problems. *Id.* The FDA like the NCI

focusses on animal and cell studies rather than the epidemiology that the WHO/IARC found persuasive. The FDA's statement that the majority of animal and cell studies fail to show a health problem provides some comfort with the caveat that new lines of research are being undertaken, replicated and examined, and there were credible studies to convince the WHO/IARC to reclassify RF/EMF as a potential carcinogen. Neither the NCI nor the FDA disagrees with the WHO/IARC reclassification.

Field tests of CMP's smart meters in operation tend to confirm laboratory testing and calculated RF exposure levels. Both the OPA and Exponent conducted field tests and the results of both studies support the conclusion that the exposure levels from CMP's smart meters and related equipment are below the ICNIRP, Canadian, FCC and other jurisdictions' limits. *Examiners' Report* at 38-39.

L. AMI meters are safe under average/normal/standard operating conditions

While a threat or hazard always exists at some level, the level of that threat varies depending on the conditions and exposure. Water can be toxic if consumed in sufficiently high dosage. The Complainants' expert Dr. Hardell submitted materials obtained directly from the WHO/IARC Responsible Officer that confirms in the case of RF/EMF, the toxicological principle that exposure level varies the level of threat or hazard.³⁹ In addition to the Dr. Baan email quoted above, Dr. Hardell submitted a second email from Dr. Baan, the IARC Responsible Officer for Monography 102 on RF-EMF, with his direct testimony. *Hardell Test*. Exhibit E (email from Dr. Baan at IARC dated March 30, 2012). In this email, Dr. Baan writes:

. . . the IARC Working Group did not want to restrict the overall evaluation to "RF-EMF from mobile phones" or to "RF-EMF from mobile phones that were used in the late 1990s" or to "RF-EMF from mobile phones that were used in the INTERPHONE study", [sic] since many other devices emit the same type of RF radiation, e.g., base-station antennas, radio/tv antennas, WiFi [sic] stations, smart meters, etc. Therefore all these fall under the same broad evaluation of "Radiofrequency Electromagnetic Fields". [sic] This is what the Working Group discussed and decided last year. Of course, because the exposure levels for many of these devices and exposure situations are so much lower than the exposure to someone who has a functioning cell

³⁹ "One of toxicology's central tenets is that the dose makes the poison. This notion was first attributed to sixteenth century philosopher-physician Paracelsus, who stated that [a]ll substances are poisonous—there is none which is not; the dose differentiates a poison from a remedy. Even water, in sufficient doses, can be toxic." *Borg-Warner Corporation v. Flores*, 232 S.W.3d 765, 770 (Tex. 2007) (internal citations and quotations omitted).

phone against her/his ear, the risk will be considerably less (although the hazard still exists).

Id.

The inclusion of RF from smart meters in the WHO/IARC reclassification is clear from this email, as is the recognition that exposure levels are "considerably less" though it cannot be said that no hazard exists. Drawing a conclusion on what threat or hazard constitutes an acceptably safe level of exposure – a credible risk of harm – is the task before this Commission.

It cannot be concluded that a zero exposure level is the only reasonable level of risk to allow for a positive safety finding. Man-made forms of RF/EMF are omnipresent in modern society from older radio/TV transmissions to modern wireless phones and Wi-Fi technologies. Based on the evidence reviewed herein and provided accommodations are made for those with medical treatment recommendations, CMP and analysis by other governmental and standards organizations in the record have established the relative safety of the AMI meters operating under typical parameters and that the meters do not constitute a credible threat to the health and safety of CMP's customers. I decline to disregard CMP's average/typical values as Mr. Friedman suggests and in fact rely upon that information to find that under the average/typical operating parameters the CMP meters meet a contemporary standard of safety. *Friedman Exceptions* at 20. If not, this Commission would establish an exposure standard of RF/EMF exposure that is between two and five orders of magnitude (roughly 100 to 100,000) times more stringent than currently in use for cellular phones and similar cordless and other household devices. There is some amount of risk to be sure ("the hazard still exists") but far less than most Americans knowingly and unknowingly experience virtually every day from devices found in the workplace, marketplace, homes and other public fora.

At an average duty cycle, CMP's meters would meet all the referenced governmental standards even for a person standing six inches from the meter full-time. For a single meter, the most restrictive governmental standard would be met for a person 17 inches away during operation at its maximum 10% duty cycle though this standard involved averaging the exposure and ignores potential peak exposure impacts.

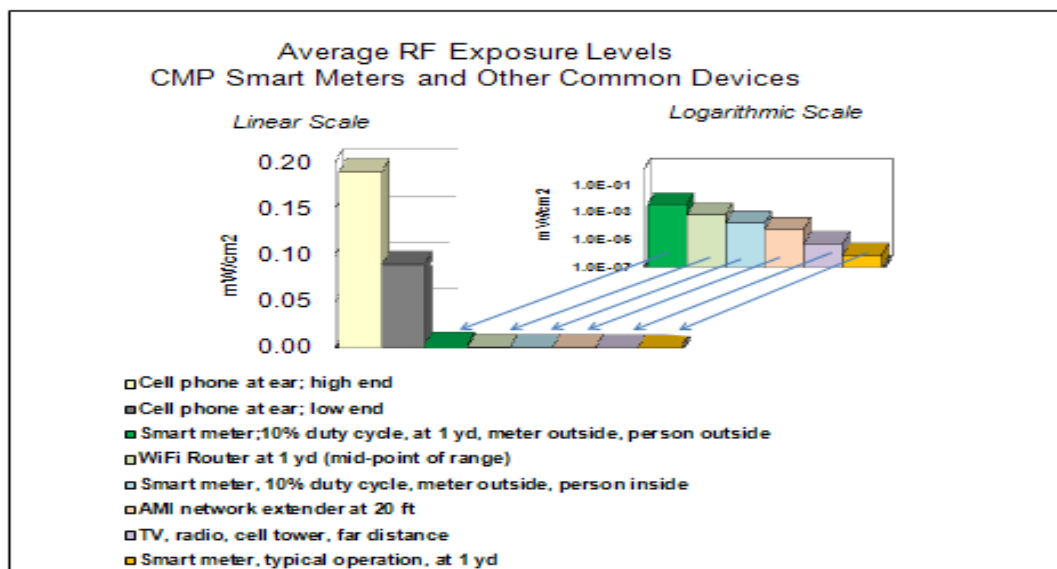
Comparisons of RF exposure levels of smart meters with other RF emitting devices are shown in Table 2 and Figure 1 below:

TABLE 2⁴⁰

RF Exposure Levels from CMP AMI and Other Common Devices

Source: ODR-01-29 and TX Study

Device	Location	Average Exposure (mW/cm ²)	Notes
FCC limit		1.000000	
Cell phone	At ear	0.190000	High end of range
Cell phone	At ear	0.090000	Low end of range
Smart meter @ 10% duty cycle	1 yard away, meter and person outside	0.003100	Max. operating time
WiFi router	1 yard away	0.000200 to 0.001000	Constant operation
Smart meter @ 10% duty cycle	1 yard away, meter outside, person inside	0.000150	Max. operating time
AMI network device	20 feet away	0.000054	
AMI network device	60 feet away	0.000006	
TV, radio, cell towers	Typical distances away	0.000005	
Smart meter @ typical operation	1 yard away, meter outside, person inside	0.0000008	

FIGURE 1⁴¹

Inside a building where people spend the majority of their time, the exposures are much less. A comparison of exposure levels in Table 2 above shows that a smart meter located outside a building under typical operation exposes a person inside a

⁴⁰ Table 2 is also found on page 19, above.

⁴¹ Figure 1 is also found on page 19, above.

building 1 yard away to an exposure level that is five to six orders of magnitude lower than a cellular phone located at a person's ear. This ignores the potential risk of peak or "burst" exposures, but does establish that when averaged as allowed by the FCC, smart meter exposures to RF in this configuration are roughly between 100,000 and 1 million times lower than a cell phone held at the ear in rough order of magnitude terms. For a repeater (AMI network device at 20 feet away), the exposure of a person is three to four orders of magnitude lower or roughly 1000 to 10,000 times lower than a person holding a cell phone at their ear. And for a repeater at 60 feet away, the exposure is four to five orders of magnitude lower or roughly 10,000 to 100,000 lower than a cell phone held at the ear. These are all averaged and not what Complainants refer to a peak (or "burst") emissions.

The differences in exposure are so great that Fig 1 must use a logarithmic scale to show the differences. The primary distinction that makes a difference is the distance, e.g., extent of exposure. "[E]ven at the maximum 10% duty cycle, CMP's smart meters meet the most restrictive governmental standards identified in Section VI of 0.01 mW/cm² provide a person was at least 17 inches from the meter during operation." *Examiners' Report* at 44. However, a hundred or more meters together operating at a maximum duty cycle may be close to the FCC standard and would exceed the lowest governmental standards, thus some reason for caution. "At the average duty cycle, CMP's meters would meet all of the referenced governmental standards even if a person stood only six inches from the meter for the full time that is operated." *Id.* However, at a maximum duty cycle, a person within 6 inches may receive a higher exposure though it is unrealistic to assume a person will be within 6 inches of a smart meter all of the time. From inside a building, the exposures would be even less. This is consistent with Exponent's testimony that CMP's smart meter mesh network and the supporting facilities are not a significant source of exposure, constituting "much less than 1%" of the FCC's exposure limit. Joint Testimony of Erdreich, Bailey, Shkolnikov, Docket No. 2010-00345 at 27 (Nov. 16, 2010). As indicated by the OPA's field measurements, however, I am not convinced the exposure is as low as Exponent calculates for multiple meters in dense urban installations.⁴² When OPA's field measurements are combined with the averaging of emissions allowed by the FCC, there is some reason for caution that burst or peak exposure are not as well studied in general nor illustrated on this record because the FCC standards allow for averaging.

M. Exponent has not proven the meters are safe under the worst case operating condition as described by Dr. Bailey

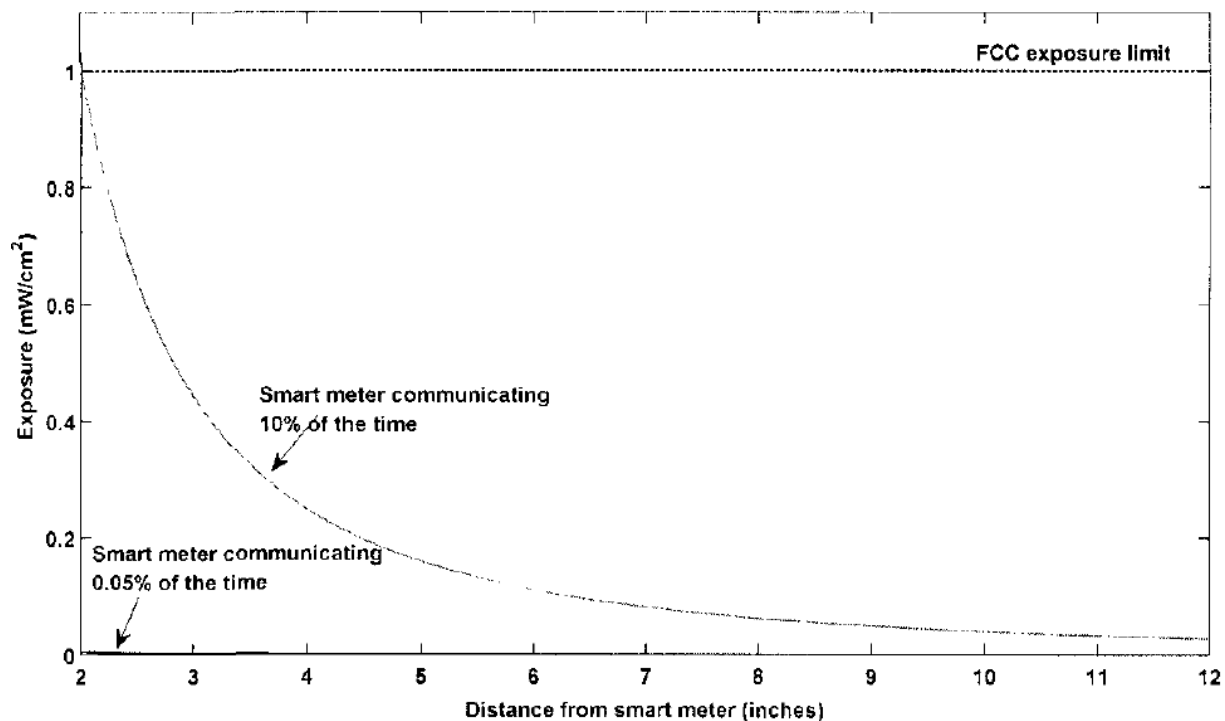
As a matter of evidence and burden of proof, Exponent has not provided sufficient measurements or assessments of levels for the worst case scenario that Dr. Bailey acknowledged on cross examination. The worst case for a bank of meters at 10% of duty cycle is also not addressed (with or without a number of descendants).

⁴² This concern is highlighted by the OPA consultant perhaps missing some or all of the peak level of transmission during the smart meters highest emissions period in the hours immediately after midnight.

CMP has not presented evidence or measurements to support full operations at 10% of the duty cycle with large banks in an urban environment. Exponent's expert identified a worst case exposure scenario, but failed to adequately address this worst case scenario. For our immediate purpose today, we are not aware that this is a current, or perhaps even likely, operational scenario for the meters as currently deployed. In any event, if CMP wishes to operate the AMI meters close to this so-called worst scenario, it should make a showing to the Commission that the RF levels are safe operated at 10% duty cycle in the largest bank configuration(s) that would occur in its service territory.

CMP's own filings illustrate the dramatic difference in exposure from a smart meter communicating 0.05% of the time and 10% of the time. Figure 2 below, presented by Exponent, shows that at 10% run time the exposure is higher and closer to the FCC exposure limit at 2 to 5 inches from a single meter than farther distances:

FIGURE 2
Power Density of a Smart Meter Decreases with Distance



Source: Joint Testimony of Erdreich, Bailey, Shkilnikov, Docket No. 2010-345, Fig. 2 at 27 (Nov. 16, 2010).

Figure 2 illustrates how the exposure in power density (in milliwatts per square centimeter) decreases substantially with distance from a single meter. Examining this figure, one can see that a single meter produces a power density just below 20 percent (0.2) of the current FCC exposure limit at 5 inches, thus ten meters would be near the

FCC limit and a dozen meters perhaps above the current FCC exposure limit at five inches if not protected by a wall and the back of the smart meter. Accordingly, a meter bank of several dozen meters in close proximity may exceed the FCC limit but evidence has not been submitted to the Commission on large installations of meter banks other than a conclusory letter from an FCC official and EPRI's study of another type of smart meter. The Commission needs clear evidence to show that the largest installations of meter banks in Maine produce RF/EMF levels that provide for safe service consistent with contemporary national and international safety standards for RF radiation.

CMP's smart meters have a peak power level of between 0.41 mW/cm^2 and 0.44 mW/cm^2 which is well below the ICNIRP, IEEE, FCC and most national limits of 1.0 mW/cm^2 – even without taking the duty cycle into account. Mr. Friedman, Ms. Wilkins and Ms. Foley-Ferguson correctly point out that those measurements and the FCC standard are based on averaged and not peak exposure. And further, the evidence on meters in multiple configurations shows that RF may approach the ICNIRP, IEEE and FCC limit. The OPA field test result of 13.4% for one area with multiple meters suggests that overall RF may be close enough to governmental standards to require additional showing on reasonable worst exposures for areas where a utility might deploy multiple banks of smart meters that may operate closer to the 10% duty cycle than today. Against the evidence in this record, the FCC's letter statement by Knapp alone is conclusory and insufficient without a further evidentiary showing. This is a sufficiency of evidence finding and not a finding of whether or not the meters are safe in dense urban environments.

For guidance to the parties should CMP decide to pursue such a showing, a well done study such as EPRI's with specific field design or in an area that CMP identifies as high-deployment may be one avenue to provide such additional evidence. The theoretical worse case of many banks of meters operated at or near a full 10% duty cycle is not an issue for CMP's current system on this record. So the safety issue is not litigated for higher exposures than CMP's average/typical exposures, nor is there evidentiary support for such measured exposures. For this reason, operation of these meters in the future at higher duty cycles near higher "worst case" exposure scenario is an issue remaining for another day and proceeding. The Commission is not aware of any such exposures in Maine, and CMP does not operate its current meters anywhere near the full 10% duty cycle in banks or alone. Although future studies, measurements and theoretical calculations may suffice, the evidence in the record of this proceeding is insufficient, on what has been described as a worst case multiple-meter operating condition, to draw any reasonable conclusion at this time.

N. Customer No-Cost Opt-Out Under Certain Conditions Represents a Low-Cost Mitigation Measure

The issues in the Opt-Out Orders are before us in this case because they were included in Mr. Friedman's complaint. The Law Court observed in its opinion that Mr. Friedman's complaint asserts that the fees for the opt-out are unjust. *Friedman*, 2012 ME 90 at ¶ 8. Further, the Law Court reversed and remanded the Commission's finding

that the Opt-Out Orders adequately addressed the safety issue. Because Mr. Freidman's complaint here raises the appropriateness of the Opt-Out Orders, the Opt-Out Orders and the Commission's lack of a safety finding are before the Commission because it is squarely raised in the 10-person complaint here.⁴³

What is appropriate, if anything, to address the testimony, statements and concerns of the Complainants on remedy given the evidence presented on safety. I observe that the description of the Complainants as "a small but vocal group tied to a nationwide crusade against RF wireless technology" is not persuasive. *CMP Brief* at 2. More than 8,000 of CMP's ratepayers appear to share Complainants' concerns. CMP's statements do not assist it in meeting its burden of proof and such labelling of concerned citizens and ratepayers is unnecessary. In fact, the concern of 8,000 to 9,000 CMP customers is evidence in itself which the Commission should weigh heavily. Likewise, one of the Complainant's bias filing against some of the Commission staff is not helpful to the extent it represents an *ad hominem* attack on Commission staff. .

The testimony this Commission received in writing and in person expresses significant concerns and attributes health issues to these meters. In assessing the Complainants health concerns, it is possible that some of those complaining have a sensitivity that is clinically manifest. The Austrian Medical Association has produced a document for diagnosis and treatment of EMF-related health problems and illnesses but other medical organizations have not followed suit. *Guideline of the Austrian Medical Association for the Diagnosis and Treatment of EMF-Related Health Problems and Illnesses (EMF syndrome)*, Consensus paper of the Austrian Medical Association's Working Group (March 3, 2012). I make no finding regarding the validity or not of EMF-syndrome and do not believe this Commission needs to do so. While the WHO has stated that studies have not shown that electromagnetic hypersensitivity (EHS) symptoms are attributable to EMF, it has also noted that those symptoms are nevertheless real and at times can be debilitating. WHO, "Electromagnetic Fields (EMF): Fact Sheets and Backgrounders (Dec. 2005) (*available at* <http://www.who.int/mediacentre/factsheets/fs296/en/index.html>). The same observations can be based on the testimony of CMP's customers, some of whom attest to symptoms that are real.

⁴³ The Court requires the Commission to examine whether it can make a finding that was absent from the original AMI approval, absent from the opt-out order arising from an earlier citizen complaint, and absent from our decision on this Complaint regarding safety. In this context of a later filed 10-person complaint, it is unclear of the extent to which the Court allows a collateral attack on a prior Commission approval of the AMI approval and the 10-person complaints resulting in the opt-out order. Further, it is unclear whether a final Commission Order can be reexamined by way of the 10-person complaint procedure.

As Dr. Hardell correctly notes:

The appropriate scientific response to inconsistencies is to perform further studies with a goal of resolving the inconsistencies with a better or more comprehensive theory. It is not appropriate to ignore or discard the inconsistent observations, unless there is reason to conclude that the experiment was poorly designed or carried out.

Data Request CMP-003-011.

In this proceeding, multiple witnesses who are Maine citizens and CMP customers have submitted testimony regarding their own experience with RF/EMF; these submissions are evidence. Appendix B to this Order is a summary of some but not all of those statements. I take the sworn testimony as representative of the concerns of the roughly 8,000 CMP customers who have opted-out. Some of these sworn statements and testimony are credible and some not. Particularly helpful is the testimony of Julie Tupper, Cynthia Krouse, Jack and Deborah Heffernan, and Joyce Flanagan, among others, who cite medical recommendations to avoid RF exposure. I note that medical opinions would be preferred from doctors or practitioners who can make treatment recommendations, but that does not mean that recommendations by non-doctors and non-practitioners have no credibility. On the other hand, there is lay testimony that symptoms exhibited become worse when a smart meter was removed and attributing those to a neighbor's smart meter, which is an example of not so credible testimony. In addition to approximately two dozen types of health impacts asserted by CMP customers submitted to the record in sworn form, the Commission is aware that over 8,000 CMP customers had adopted out for various reasons.⁴⁴

Further, the Commission has received expert evidence from treating physicians that patient symptoms are associated with AMI meters and other sources of RF in the home. *Rea Test.* The Commission has heard from an apparently well-respected former treating physician outside Maine, Dr. William J. Rea. Dr. Rea was a cardiovascular surgeon practicing in Ohio and Texas as well as an assistant professor of cardiovascular surgery at the University of Texas S.W. Medical School and Chief of Cardiovascular Surgery at Veteran's Hospital. *Id.* at 1. Dr. Rea has authored five medical textbooks and more than 150 peer reviewed research papers. *Id.* at 3.

⁴⁴ While some additional public comment is not sworn testimony, it is appropriate to recognize the public comment without considering or relying upon such statements as record evidence. The Commission has in this last session of the Legislature explained that record evidence must be sworn or affirmed but that the Commission notes public comments submitted without considering it in the evidentiary record for purposes of making decisions. The Commission has also made a clear effort in this case and others recently to explain to the public that their statements must be sworn or affirmed to be considered record evidence.

Dr. Rea has treated patients who complain of sensitivity to smart meters, and he recommends that those patients reduce exposures. Dr. Rea's clinical experience as well as his study of EMF sensitivity cause him to conclude that exposure to RF radiation does have health effects in some people. *Id.* at 3-7. We also heard evidence from a number of CMP customers who testify to the same effect. Dr. Rea specifically recommends treatment to include avoidance of smart meters for patients exhibiting such symptoms. *Id.* at 7.

It appears that some medical practitioners like Dr. Rea advise patients to avoid these exposures, perhaps without opining on medical cause. On balance, the public testimony together with the 8,000 opt-outs and testimony of Dr. Rea support a reasonable supposition that there may be symptoms for some people related to the installation of smart meters. It is a reasonable concern on the behalf of many CMP customers even if not capable of satisfying a more-probable-than-not burden of proof that smart meters cause their asserted health effects.

In addition to diagnosing medical conditions, doctors and medical practitioners clinically treat and understand symptoms. Symptoms are treated clinically even when medical science does not explain cause and effect and indeed when a condition cannot be diagnosed.⁴⁵ I am reluctant to utterly disregard evidence from many CMP ratepayers and some competent medical evidence from health care providers. As with other physician recommendations in the case of disconnection cases where customers need electricity for medical reasons, this Commission generally will accept medical opinions and recommendations of treating physicians as valid. See, e.g., Chapter 815, § 11 of the Commission Rules (physician's certification concerning a medical emergency justifying continuation of electricity service). There is no reason to vary from the Commission's practice established elsewhere in Commission rules where a treating

⁴⁵ It is a bit of a red herring to consider whether patients may or may not be able to consciously distinguish the presence of RF fields or whether electromagnetic field (EMF) hypersensitivity is a real medical condition or not. The research is mixed with some studies showing symptoms are not related to RF exposures and other studies showing 100% reproducible reactions to frequencies each individual is sensitive to. *LBNL Memo* at 4 (citations omitted), citing AAEM submission. The studies on conscious ability to distinguish RF fields are mixed, with the WHO concluding that "Well controlled double-blind studies have shown that symptoms were not correlated with EMF exposure." *LBNL Memo* at 5 (citations omitted), citing WHO, "Electromagnetic fields and public health," Electromagnetic hypersensitivity, Fact Sheet N 296, Dec. 2005 (*available at* <http://www.who.int/mediacentre/factsheets/fs296/en/>). There are documented disagreements as to reproducibility of studies showing people are consciously sensitive to EMF. *Id.* This proceeding, however, is not about, and no outcome hinges on, whether RF or EMF sensitivity is conscious or not and whether these sets of outcomes are valid or not. And the main impetus of Exponent's questioning whether EMF hypersensitivity is a real medical condition is to suggest that RF sensitivity cannot be conscious and thus must be psychological rather than a medical, physiochemical or genotoxic.

medical profession makes treatment recommendations. Indeed I find that it is an unreasonable utility practice for CMP to do so.

The involuntary nature of this risk is a consideration. Customers must accept meters as a condition of electrical service. Having no electrical service is not a practical or feasible decision for families and businesses in 21st century United States. This is different from one-hundred years ago when some farms in Maine had no electricity and could operate self-sufficiently. Now virtually every primary residence in Maine has electricity. These meters are now CMP's standard meter. The older analog electro-mechanical technology appears to be headed to obsolescence with utilities across the U.S. and Europe installing different versions of AMI technologies.

I do not agree with CMP's experts when they suggest that a causal relationship is necessary – essentially requiring a classification of AMI meters as a known carcinogen – for this Commission to take any measures to protect customer safety. This would shift the burden to the Complainants of proving causation of a safety risk which violates the Commission practice of putting the burden on the utility but also the governing statute which codifies an affirmative obligation on the utility to "furnish safe, reasonable and adequate facilities and service." 35-A M.R.S. § 301.

The shift of the burden to the Complainants in contravention of Section 301's affirmative utility safety obligation would be problematic because the lack of scientific proof of causality avoids any need on the Commission's part to consider any reasonable risk mitigation. This is not consistent with Commission practice in other cases. It is simply inaccurate to suggest that the lack of scientific "proof of causal relationship" means that no reasonable risk mitigation can be considered or required, particularly low or no cost risk mitigation measures.

Rather, I find in light of the WHO/IARC reclassification as a possible carcinogen and the evidence presented in this case that low-cost and no-cost risk mitigation measures are advisable. The Section 101 and Section 301 obligation on the utility and this Commission to provide safe service make it appropriate to consider low cost or no cost mitigation of risk. To be specific, it is appropriate to consider low cost or no cost mitigation of risk where there is some credible evidence of risk, but that credible evidence of a risk falls short of a likelihood of harm and short of a credible threat of harm to the health and safety of customers. Such consideration of reasonable risk mitigation is part of the safety determination under Sections 101 and 301.

Indeed, the Commission itself has adopted precisely such an approach to risk mitigation in the MPRP proceedings addressing EMF risk as discussed earlier in this opinion. In a number of abutter disputes regarding CMP's high-voltage transmission lines, the Commission considered health claims under an MPRP Stipulation that provided that "CMP will take all reasonable steps to mitigate EMF consistent with World Health Organization recommendations," which WHO recommendation is that governmental authorities mitigate high levels of EMF when mitigation is low or no cost. *MPRP Order; Curtis Order; Fournier Order.*

Neither causality nor quantified risk are pre-requisites for reasonable risk management measures. When science cannot produce a precise quantification of potential risks, costs, and damage, yet there is evidence of potential or possible harm, an agency charged with protecting safety can nonetheless move forward judiciously to determine respective obligations and rights in the context of a public interest standard. 35-A M.R.S. § 101 ("The purpose of this Title is to ensure that there is a regulatory system for public utilities in the State that is consistent with the public interest . . ."). Innovative technologies in the context of developing science, engineering and medical understanding may necessitate limited precautionary approaches to safety in light of uncertainty presented by scientific studies and new technology.

One example is a Hawaii decision that considered claims of water resource damages in the context of approvals for water withdrawal and water uses. The Hawaii Commission was operating under a similar public interest standard and found in a series of cases that a precautionary approach is advisable when the evidence even carefully weighed does not lend itself to an exact quantification of benefits and risks. The Hawaii Supreme Court upheld the Commission's action that it should estimate a sustainable yield figure including reasonable precautionary measures:

[T]he Commission may make reasonable precautionary presumptions or allowances in the public interest. The Commission may still act when public benefits and risks are not capable of exact quantification. At all times, however, the Commission should not hide behind scientific uncertainty, but should confront it as systematically and judiciously as possible—considering every offstream use in view of the cumulative potential harm to instream uses and values and the need for meaningful studies of stream flow requirements.

In the Matter of the Contested Case Hearing on the Water Use Permit Application Filed by Kukui (Molokai), Inc., 174 P.3d 320, 339 (Haw. 2007) (quoting *In re Water Use Permit Applications*, 94 Haw. 97, 159-60; 9 P.3d 409, 471 (2000)).

The Hawaii Supreme Court found that where the state of the science obscures exact calculation, it is nonetheless appropriate to engage in systematic and judicious examination of values, risks and potential harms at stake.

Therefore as part of the safety finding under Section 101 and Section 301, Commission precedent suggests it would be appropriate to mandate that CMP allow those customers with RF-related symptoms who submit documentation of a licensed doctor's or licensed medical practitioner's treatment recommendation to have such recommendation considered. This consideration would be in the same manner as the Commission does under Chapter 815 for physician certifications allowing continued electricity for medical reasons. Specifically, if limited RF/EMF exposure is recommended by a doctor or medical practitioners, I would address the pending Complaint by allowing for an AMI meter in a no transmit mode or turned off at the

ratepayer's primary residence at no cost. This would meet the statutory mandate of safe, reasonable and adequate utility service.

This new exception is limited to those with treatment recommendations from a medical practitioner allowed by law to prescribe medical treatments. This is generally licensed doctors and licensed medical practitioners and would not extend to some of the health care providers in this record such as nutritionists or acupuncturists who are not licensed to prescribe medical treatment. Thus as part of the safety finding, there is a low cost or no cost accommodations to recognize that there is some credible evidence of risk of chronic effects. I find it is not a reasonable utility practice for CMP to fail to provide sufficient risk mitigation and that CMP should provide an AMI meter with a transmitter turned off if recommended by a licensed doctor or medical practitioner. This is less cost to CMP and ratepayers to utilize the AMI-meter-with-transmitter-turned-off than an analogue meter and provide more system flexibility to turn meters on when requested.

I would therefore incorporate this reasonable low cost or no cost measure for those who submit documentation of a licensed doctor's or medical practitioner's treatment recommendation to have an AMI meter in a no transmit mode or turned off at their primary residence to qualify for a no-cost opt-out option.

Consistent with the Commission's safety mandate in Sections 101 and 301, I conclude that turning off transmitters is a reasonable medical accommodation pursuant to a doctor's or medical practitioner's treatment recommendations. The AMI meter is now CMP's standard meter and a non-transmitting option will address any medical issues identified by a treating physician or medical practitioner qualified to make such treatment recommendations.

X. OPINION OF COMMISSIONER VANNOY

A. Overview

The Legislature has charged the Commission with the responsibility of regulating the rates and operations of public utilities in Maine. As stated in 35-A M.R.S. § 101, the purpose of Commission regulation is as follows:

The purpose of this Title is to ensure that there is a regulatory system for public utilities in the State and for other entities subject to this Title that is consistent with the public interest and with other requirements of law.... The basic purpose of this regulatory system as it applies to public utilities subject to service regulation under this Title is to ensure safe, reasonable and adequate service, to assist in minimizing the cost of energy available to the State's consumers and to ensure that the rates of public utilities

subject to rate regulation are just and reasonable to customers and public utilities.

Maine law further requires that "every public utility shall furnish safe, reasonable and adequate facilities and service." 35-A M.R.S. § 301. In addition, with respect to smart grid technology implementation, the Commission has the specific statutory obligation to ensure that utilities meet applicable standards for reliability, safety and security. 35-A M.R.S. § 3143.

It is important to emphasize, however, that the Commission is neither a health nor a scientific agency, and it is clearly not the role of the Commission to resolve the scientific debate regarding potential health impacts of RF emissions. The Law Court specifically recognized the Commission's lack of technical expertise to conduct an independent investigation of these issues:

Although the Commission may not have the technical expertise necessary to conduct an independent investigation on this issue, the Commission's orders appear to recognize that other state and federal agencies do. As an administrative body authorized to conduct hearings and engage in fact-finding, the Commission is not precluded from considering the findings and conclusions of other state and federal agencies.

Friedman et al., 2012 ME 90, ¶ 11 n. 7.

Therefore, in my view, the Commission's role is to resolve the question as to whether CMP's installation and operation of wireless smart meters and the associated mesh network constitutes a safe, reasonable and adequate utility service.⁴⁶ In determining safety as the Court directed, we must answer the question as to whether the RF emissions of smart meters represent a credible risk of harm to CMP's customers. In making this determination, the Commission should review and give weight to all of the scientific and health information contained in the record before it.

In determining safety as the Law Court directed, the Commission must answer the question as to whether the RF transmissions of smart meters represent a credible threat of harm to CMP customers. However, the Commission should also review the matter in a broader context that includes an examination of the compliance of CMP's smart meters with all applicable federal or state regulations; determinations and conclusions by other state, federal, and international agencies on RF emissions

⁴⁶ In response to Mr. Friedman's Exceptions at 1-2, it should be emphasized that the Commission must find that the meters are "safe." The Commission may not balance safety against "reasonable" and "adequate" service.

generally and smart meters specifically; and the pervasiveness of RF emitting devices in the environment.

Finally, it is important to emphasize that the question of safety in this context is a public policy determination and not a scientific conclusion. The responsibility for determining "safety" lies with government agencies, not individual scientists.⁴⁷ The Legislature in its charge to the Commission to ensure "safe, reasonable and adequate" service could not have intended that the Commission ensure absolute safety with zero risk of harm; this is particularly true with regard to electricity which, by its very nature, has inherent safety risks. Safety is a relative and contextual term, determined not only by an understanding of the scientific evidence and potential risks, but also by a policy judgment as to the acceptability of those risks given the benefits of the technology.

B. Legal Standards and Burden of Proof

As stated above, the question before the Commission in this proceeding is whether the installation and operation of CMP's smart meters constitutes safe, reasonable, and adequate utility facilities and service. It is CMP that has the burden to demonstrate compliance with this statutory directive. 35-A M.R.S. § 301. CMP must make this showing by a preponderance of the evidence. *Re: Request for Commission Investigation Into the Reduction of Services to the Residents of Jackman and Surrounding Communities*, Docket No. 1994-00462 (Sep. 1, 1995) (utility, in ten-person complaints, has the burden to prove by preponderance of evidence that its service is safe, reasonable and adequate).

Mr. Friedman argues that that the Commission should employ a heightened level of scrutiny in this proceeding because the issue involves the safety of Maine residents and, therefore, CMP must provide enough reliable scientific evidence to conclude with a high degree of certainty that there is no risk of harm and that safety is ensured. *Friedman Brief* at 7-8, 72. I agree that the issues before the Commission in this proceeding are of substantial importance. However, there is no basis in law for a heightened standard of proof and the utility's burden in this proceeding, as stated above, is to demonstrate by the preponderance of the evidence that the installation and operations of its smart meters constitute a safe, reasonable, and adequate utility practice. It is simply impossible for CMP or anyone else to "prove" with the degree of certainty apparently advocated by Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson that low-level RF emissions have no potential to cause harm under all circumstances. Science simply cannot prove a negative. Such a requirement or standard of proof logically would lead directly to prohibition of smart meter deployment with the implication that all RF emitting devices should be banned and could raise difficult questions with

⁴⁷ In this respect, I agree with the position of CMP's witnesses as expressed on Page 152 of their Rebuttal Testimony.

regard to other utility facilities and practices, for example, the operation of power lines and natural gas pipelines cannot be said have zero risk of harm to the public.⁴⁸

C. Compliance with RF Emission Standards

The evidence in this proceeding demonstrates that CMP's AMI network is in compliance with the FCC, Health Canada, and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), as well as other governmental standards. As discussed in Section VI above, the FCC has the direct federal authority to promulgate rules regarding emissions and safety associated with RF devices and therefore compliance with FCC standards is of utmost importance in our review of the safety of CMP's smart meters.

1. FCC Smart Meter Certification

As discussed above, smart meters are required to be tested and evaluated in certified laboratories prior to sale to utility companies to ensure their compliance with the FCC's RF exposure limits. No party has contested the fact that, prior to CMP acquiring Trilliant's Smart Meter and Mesh system, the safety of that equipment was established through the FCC application process by Trilliant for the FCC Grant of Equipment Authorization. CMP has deployed only equipment that has been certified by the FCC for compliance with the appropriate safety levels.

For CMP's smart meters, the FCC compliance testing showed peak signal strength of between 0.41 mW/cm^2 and 0.45 mW/cm^2 at a distance of 20 cm, well below the FCC limit of 1.0 mW/cm^2 even without taking the duty cycle of the meters into account.⁴⁹ At a distance of 3 feet, the peak signal would be expected to have degraded to approximately 0.02 mW/cm^2 , and at the average smart meter duty cycle, even if it all occurred in the same thirty minute period, the thirty-minute average exposure at three feet from the smart meter would be reduced to approximately 0.00005 mW/cm^2 , approximately 20,000 times below the FCC standard. Even at the maximum duty cycle of 10%,⁵⁰ the exposure would be approximately 500 times below the FCC standard.⁵¹

⁴⁸ Several of Mr. Friedman's witness would not support an outright ban of RF emitting devices. See Section XI(G), below.

⁴⁹ Landis+Gyr FOCUS AX = 0.411842 mW/cm^2 ; GE I-210 = 0.445379 mW/cm^2 (ODR-03-05, pages 8 and 49, respectively).

⁵⁰ The 10% duty cycle limitation is imposed to prevent signal interference and is not a function of human health concerns.

⁵¹ $S_{\text{at } 20\text{cm}} = 0.411842$, $S_{\text{at } 36\text{in}} = 0.411842 / (36\text{in} * 2.54\text{cm/in} / 20\text{cm})^2 = 0.0197 \text{ mW/cm}^2$; $S_{\text{at } 20\text{cm}} = 0.445379$, $S_{\text{at } 36\text{in}} = 0.445379 / (36\text{in} * 2.54\text{cm/in} / 20\text{cm})^2 = 0.0213 \text{ mW/cm}^2$; Average duty cycle at 4.4 seconds over 30 minutes = $4 / (30\text{min} * 60\text{sec}) = 0.24\%$. Thirty minute Avg S (at 0.24% duty cycle) = between $0.0197 * 0.0024 = 0.000048$ and

2. Field Tests of CMP Smart Meters

For purposes of this proceeding, both CMP and the OPA undertook and submitted the results of field measurement studies of the RF emissions of CMP's smart meter system as a means to confirm compliance with FCC standards. The results of both studies support the conclusion that the exposure levels from CMP's smart meters and related equipment are well below the FCC MPE limit.

CMP's study was undertaken by Exponent to validate its previously calculated RF exposure levels. The Exponent study involved measurements at three smart meter sites selected from a sample of 1,100 meters from which signaling frequency (*i.e.*, number of signals) data had been collected. Based on the signaling frequency data, Exponent selected three sites with smart meters considered to communicate at the low, typical and high points of the signaling frequency range. Exponent's measurements were all performed outside the residences at a distance of 3 feet from the smart meter. None of Exponent's measurements (recorded on a running, 30-minute average) exceeded the lower detection limit of its equipment of 0.00017 mW/cm². It should also be noted, that these measurements would have included all RF sources (not just the subject meter) within the detection band of the equipment.

The OPA's study, (conducted by True North Associates and C2 Systems,) involved three smart meter sites, plus two repeater sites and one extender bridge site. Two of the three smart meter sites it chose were in densely populated parts of Portland, and the third was at a single-family home in a more rural area. Sites 1 and 2 were at three and nine smart meter banks, respectively. The two repeater sites were in densely populated parts of Portland and each had over 5,000 smart meters within a half mile distance. The extender bridge was in a commercial/residential part of Westbrook and listed as supporting over 2,000 smart meters. Unlike Exponent's configuration, the equipment measured both the maximum as well as the average exposures, based on the 6 minute average for occupational exposure. For the meter survey, the OPA's study measured two readings below the limit of reliability identified for the equipment it was using (at Sites 2 and 3) and one reading above that value (Site 1). The Site 1 reading was reported as 13.4% of the MPE for the general population. The OPA's study of the extender bridge and repeaters were reported to be less than 1% of the FCC general public MPE.

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson argue that these studies do not provide any validation of FCC compliance, stating that the studies were fatally flawed for several reasons including: (1) the smart meters tested were not chosen from a statistically valid sample; (2) there is no proof that the smart meters were actually transmitting during the measurement periods; (3) the OPA study truncated measurement during the active period and may not actually have captured the most active part of that period; (4) the "worst case" smart meter configuration was not

$0.0213 \times 0.0024 = 0.000051$; Thirty minute Avg S (at 10% duty cycle) = between $0.0197 \times 0.1 = 0.00197$ mW/cm² and $0.0213 \times 0.1 = 0.00213$.

measured; (5) the measurement equipment was not sensitive enough to detect the smart meter RF; (6) peak exposure was not measured; and (7) the tests do not address non-thermal exposures.

I acknowledge that Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson raise issues with respect to the degree of certainty provided by the studies. However, because the smart meters and related equipment were tested and determined to be compliant with FCC limits prior to being acquired and installed by CMP, the field studies, by themselves, are not determinative of FCC compliance. Notwithstanding their alleged flaws, I conclude that these field studies are informative in that they provide support for the conclusion that the RF emissions from CMP's smart meters are far below the FCC limits as the measurements indicate.

3. Other Field Studies

In addition to the CMP and OPA field studies, the record also includes a field study of smart meter RF emissions performed by the Electric Power Research Institute (EPRI) in 2010 and by the Vermont Department of Health in 2012. Both studies concluded that RF emissions from smart meters are well below regulatory limits set by the FCC.

The EPRI study was conducted on a cluster of 10 smart meters located within a "meter farm" containing approximately 7,000 smart meters over 20 acres. The smart meters were operated continuously (100% duty cycle) for purposes of the study and measurements were taken both in front and behind the rack over a four-day period. The EPRI study reported that even under continuous operation, at one foot in front of the smart meter bank, the maximum exposure was only 10% of the FCC limit and behind the smart meter bank, even at eight inches, exposure was less than 1% of the FCC limit. *Electric Power Research Institute, "Radio-Frequency Exposure Levels from Smart Meters"* (Nov. 2010).

Although there are a number of differences between the meters used in the EPRI study and those used by CMP, the results are still useful to consider. The EPRI study meters operate at a different frequency than CMP's meters (the EPRI study used meters that operate from 902 to 928 MHz – CMP's meters operate at 2.45 GHz) and a different power level than CMP's meters (the EPRI study meters operate at 0.25 W – CMP's operate at approximately 1.0 W). However, while the power of the EPRI study meters was roughly 25% of the power of CMP's meters, in the study, the EPRI meters were operated continuously. CMP's meters are limited to operating no more than 10% of the time. In addition, because the EPRI study meters operate at a different frequency, there is a different FCC limit that applies.⁵² The FCC limit for the EPRI study

⁵² The frequency of the electromagnetic spectrum associated with the radio frequency transmission plays an important role in its biologic interaction. This is also true in considering ELF EMF. See *Data Request EXM-019-012*.

meters is the meter frequency divided by 1,500 or 0.60 – 0.62 mW/cm² (approximately 40% below the limit applicable to CMP's meters).

The Vermont Department of Health conducted a study of smart meters installed by Green Mountain Power. *Vermont Department of Health, "Radio Frequency Radiation and Health: Smart Meters"* (Feb. 10, 2012) (VDH Report). The meters examined were similar in power and frequency to the meters in the EPRI study. The VDH Report also found the exposure from the smart meters was well below the FCC limits (0.05 mW/cm² – 0.14 mW/cm² at 12 inches from the meters) and that RF levels dropped to near background levels at a testing distance of three feet or more from the meter. The VDH Report also examined RF exposure inside the residence and found that no level above the background level was detected during meter operation. Finally, the VDH Report examined the levels of RF during a remote connection and remote disconnection of the smart meter and found that the RF levels detected during this communication was similar to the levels detected during other normal operation.

4. Meter Banks

In response to particular concerns regarding banks of several smart meters, given the relative short duration of smart meter transmissions and necessary physical separation of meters, the FCC has indicated that even banks of units will be compliant with the FCC public exposure limits. As noted by the FCC:

Irrespective of duty cycle, based on the practical separation distance and the need for orderly communications among several devices, even multiple units or "banks" of meters in the same location will be compliant with the public exposure limits. These conditions for compliance are required to be met before a Grant can be issued from the EA program and auditing and review of Grants is a routine function of the FCC laboratory.

Knapp Letter.

D. Adequacy of FCC Standards

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson argue that the FCC's standards are not adequate on two basic grounds: 1) the FCC standards are based on average not peak exposures; and 2) the FCC standards are not designed to protect against non-thermal effects of RF emissions.

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson are correct that the FCC does not set a peak limit for exposure. The exposure limits are set based on the average exposure over a certain time (6 minutes for occupational exposure and 30 minutes for the general population). However, to obtain an FCC ID, FCC compliance testing requires that the peak emissions be tested and reported. In general, the FCC

assumes that in most instances, it is not possible to have sufficient information or control regarding how long people are exposed in an "uncontrolled" environment so that averaging of exposure over the designated time period (30 minutes) is normally not appropriate. However, given the known duty cycles of smart meters, as noted in the earlier-referenced letter from Julius Knapp, for smart meters, the FCC views the relevant power as the "maximum time-averaged power that takes into account the burst nature of transmission." Nonetheless, as described in Section XI(C) above, CMP's smart meters have peak exposures between 0.41 mW/cm^2 and 0.44 mW/cm^2 , well below the FCC limit of 1.0 mW/cm^2 even without taking the duty cycle into account.

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson are also correct that the FCC standards were specifically designed to prevent harm associated with thermal effects of RF, and do not explicitly address other – *i.e.*, non-thermal – potentially harmful effects. However, on this point, I generally agree with the proposition that, with respect to non-thermal effects, there is currently insufficient scientific evidence that would support a causal relationship between RF emissions and negative health effects. For example, according to the PUC TX Study "Governmental health agencies from around the world, including but not limited to the U.S., Canada, the UK, and Australia, as well as academic institutions and other researchers, have stated that there are no known non-thermal effects from exposure to RF EMF." *TX PUC Study* at 62. Given this lack of scientific evidence on causal relationship, there is no basis to determine that additional standards should be applied, nor that the absence of standards related to non-thermal effects renders the FCC standards inadequate.

It should be emphasized that, even at the maximum 10% duty cycle, CMP's smart meters meet the most restrictive governmental standards identified in Section VI above of 0.01 mW/cm^2 provided a person was at least 17 inches from the meter during operation. At the average duty cycle, CMP's meters would meet all of the referenced governmental standards even if a person stood only six inches from the meter for the full time that it operated.⁵³ From inside a building, these exposures would be substantially less.⁵⁴

Finally, I note that the Commission is not aware that any state has acted to adopt state-specific RF emission standards for any RF emitting device, and it is unclear whether a state could take such action; arguably, states could be prevented from enacting any such standards by principles of federal preemption. In any event, I do not

⁵³ Some governmental standards use a 6 minute average rather than the FCC's 30 minute average. At 4.4 seconds per 6 minutes (or 1.22% duty cycle) and CMP's $S_{\text{at } 20\text{cm}} = 0.445379$, $S_{\text{at } 6\text{in}} = 0.445379 / (6\text{in} * 2.54\text{cm/in} / 20\text{cm})^2 * 0.012 = 0.0093 \text{ mW/cm}^2$. At 10% duty cycle, CMP $S_{\text{at } 20\text{cm}} = 0.445379$, $S_{\text{at } 18\text{in}} = 0.445379 / (17\text{in} * 2.54\text{cm/in} / 20\text{cm})^2 * 0.1 = 0.0096 \text{ mW/cm}^2$.

⁵⁴ See Section VII above, the EPRI study discussed in Section XI(C)(3) above, and the VDH Report discussed in Section XI(C)(3) above and Section XI(F)(4) below.

favor the creation of a state-specific standard in this case, and, further, the Commission, in my view, does not need to reach the preemption question.

E. Scientific Studies and Health Impacts

During the course of this proceeding, the parties and public witnesses put forward numerous scientific studies for admission into the evidentiary record. The Hearing Examiners admitted over one-hundred scientific studies into the record of this proceeding. The scientific studies submitted by the parties in this matter fall into several broad categories. Studies and articles were submitted regarding the "precautionary principle," industry bias in the examination of issues regarding EMF and RF, the effects of EMF and RF on animal health, and the effects of EMF and RF on human health. Most of the health related studies centered on the emissions from cellular telephones, and the vast majority of studies focused on the effects of RF emissions on animals, primarily rats and mice. Certain of these studies have shown evidence of a statistical association with potentially adverse biological effects from the RF exposure levels studied; in particular, some studies have shown evidence of a statistical association with cellular phone use and brain tumor risk. However, most studies have not shown such an association, and, as noted above, there have been no studies provided or cited that even purport to indicate negative health effects from the much lower RF exposure levels from smart meters.

In addition, some scientific studies indicate the possibility of non-thermal biological impacts on animals from RF emissions and, possibly non-thermal biological impacts on human health from cell phone use. It should also be recognized that many individuals report a heightened sensitivity to RF emissions and attribute illness or other physical symptoms to RF exposure. Nevertheless, to date scientific studies have not identified or confirmed negative non-thermal biological impacts on human health from the RF emissions of smart meters.⁵⁵

1. The Precautionary Principle and the Hill Criteria

Generally speaking, the "precautionary principle" is an approach to scientific evidence and policy making that prescribes taking measures to forestall negative outcomes before they occur. *European Environment Agency*, "Late Lessons from Early Warnings: The Precautionary Principle 1986-2000," Env. Issue Report No. 22 (2001). Under the precautionary principle, actions to prevent such harms are usually taken "before there is strong proof of harm." *Id.* at 13.

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson, while not addressing the "precautionary principle" directly in their briefs, submitted several treatises on the subject and urged the Commission to use a precautionary approach to determining permissible levels of RF emissions from smart meters. *E.g., Friedman Brief* at 54, 72;

⁵⁵ This conclusion is consistent with that of the Maine CDC and all other governmental agency reviews of health impacts from smart meters. See Section XI(F), below.

Wilkins Brief at 28, 61, 66. Based on this precautionary approach, Mr. Friedman and Ms. Wilkins state that the only appropriate remedy is the complete removal of all smart meters and related components. *Friedman Brief* at 72; *Wilkins Brief* at 73.

The OPA acknowledges that precautionary RF emission standards are an option, but states there is no conclusive scientific evidence suggesting that current FCC standards are inadequate. *OPA Brief* at 11.

CMP cites to several sources, including the Maine CDC, that suggest the precautionary approach to RF emissions from smart meters suggested by Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson in this matter are unnecessary and unreasonably low. *CMP Brief* at 37-38. However, CMP also states that if background levels of RF were eliminated, CMP's smart meters emissions would be twenty to forty times below the lowest suggested limit: the 2012 BioInitiative Report limit. *Id.*

I recognize the existence of the "precautionary principle" and do not disagree with the general conceptual framework that there are instances where preventative measures should be adopted even in the absence of conclusive evidence of actual harm. Based on the record in this case, however, I do not find that RF emissions from CMP's smart meters, at the specific frequency and power levels of those emissions, warrant the application of the "precautionary principle" in the form and with the remedies suggested by Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson – *i.e.*, the removal of all smart meters from CMP's service territory. It should be noted that the Commission's adoption of a means for customers to "opt-out" is, in essence, an application of the precautionary principle.

In parallel with the precautionary principle, there are a number of references to the application of the Bradford Hill Criteria in evaluating statistical associations in terms of causation. These evaluation criteria include such items as strength, consistency, temporality, exposure response, and physical plausibility. In essence, what Dr. Hill's criteria describe is a methodology to apply inductive reasoning to move from particulars (specific cases in an epidemiology study) to universals where the conclusion is causation, without waiting for a deductive scientific proof of causation.

In reaching the conclusion that smart meters are safe and do not pose a credible risk of harm, I have not applied a simple deductive causation standard. Even under an inductive causation standard such as Dr. Hill's criteria, the evidence does not support a finding that smart meters pose a health risk.

Evidence in the record on the Hill Criteria is centered on RF emissions from cell phones, and the primary evidence that points to statistical associations between brain tumors and cell phone use is the ongoing work and epidemiology studies of Dr. Hardell in Sweden. In examining the question of cell phone RF radiation, including studies by Dr. Hardell and others, the Health Council of the Netherlands applied the Hill Criteria – which, as mentioned above, are inductive in nature (strength, consistency, temporality, exposure response, physical plausibility) – and concluded: "Application of Bradford Hill

considerations to the available data is not supportive of a causal relation between the use of mobile phones and the occurrence of tumours in the head." *Health Council of the Netherlands*, Mobile Phones and Cancer at 119 (June 3, 2013).

Dr. Little, senior scientist at the Radiation Epidemiology Branch of the U.S. National Cancer Institute took the WHO IARC monograph reclassification of RF radiation as a class 2B carcinogen and examined the principle findings in light of actual occurrences of cancer in the U.S. Cancer Registry. Dr. Little's team concluded:

Raised risks of glioma with mobile phone use, as reported by one (Swedish) study forming the basis of the IARC's re-evaluation of mobile phone exposure, are not consistent with observed incidence trends in US population data, although the US data could be consistent with the modest excess risks in the Interphone study.

M.P. Little, et al., Mobile Phone Use and Glioma Risk: Comparison of Epidemiological Study Results with Incidence Trends in the United States, *British Med. J.* 2012; 344 (Jan. 3, 2012).

In sum, a review of the record evidence in this matter, and the use of the Bradford Hill Criteria, support the finding that smart meters are safe and do not pose a credible risk of harm.

2. Industry Bias

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson put forward several articles discussing potential biases toward industry on the part of the scientists conducting research into RF emissions. The general conclusion of these articles is that because some science is funded by industry, or conducted by scientists who receive compensation from industry in one form or another, such science cannot be trusted as being an impartial look at the potential hazards of RF (or whatever the specific potential hazard may be). *E.g.*, *Hardell, et al.*, Secret Ties to Industry and Conflicting Interests in Cancer Research, 50(3) *Am. J. Indust. Med* (Mar. 2006); and *Hardell, et al.*, Letter to the Editor, 1-3 *Int'l J. Epidemiology* (2010).

Mr. Friedman and Ms. Wilkins frequently argue that this bias is present in the testimony provided by CMP's expert witnesses in this proceeding, and that, accordingly, the Commission should question the reliability of those experts. *Wilkins Brief* at 5, 8, 36, 45, 63; *Friedman Brief* at 30-32. Mr. Friedman and Ms. Wilkins also argue that the scientific studies that are unfavorable to their view of the case are similarly affected by bias and the conclusions of those studies should be questioned by the Commission. *Wilkins Brief* at 34-39, 45 ("the CCST, LBNL, AGNIR, INCIRP, SCENIHR, Danish Cohort, Maine CDC, and Swedish Working Life reports should be disregarding [sic] by the PUC"); *Friedman Brief* at 17 ("the AGNIR review is neither comprehensive nor unbiased").

I do not deny that it is possible for scientific studies and the scientists who conduct them to be influenced by industry to such an extent that the conclusions reached by such studies and scientists should be either disregarded or regarded dubiously by policy makers. In this case, while Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson strongly suggest that such bias is present with CMP's expert witnesses and the studies that undermine Mr. Friedman's, Ms. Wilkins's, and Ms. Foley-Ferguson's positions, there is no evidence in this case that there is any actual bias at play. The mere association of an expert witness with a utility, or the fact that that a witness is compensated by a utility, does not render null and void that expert's opinion. Likewise, the fact a particular study was underwritten by industry or that a particular scientist has received compensation in one form or another from industry does not, in and of itself, render the study or scientist unreliable. Much more is needed than innuendo and assumption to prove bias. Accordingly, I decline to use bias as a reason to diminish the weight given to CMP's experts or the studies on which they rely in this matter.

3 Animal Studies

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson have submitted many studies that address the impact of RF emissions, EMF, and microwaves on the specific organs, body parts, and biological systems (e.g., eye lenses and cornea, reproductive organs, brain, liver, kidney, blood, fertility, protein response, cellular stress) of several different animals (e.g., rats, mice, rabbits, insects).

While many of these studies suggest potential adverse impacts of RF emissions, EMF, or microwaves on animals at certain frequencies and power levels, none of these studies address the potential impact of RF at the frequency and power levels emitted by CMP's smart meters. Indeed, the exposure levels in the animal studies submitted by Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson are much greater, in many cases several orders of magnitude greater, than the RF exposure levels associated with CMP's smart meters, even emissions measured in extremely close proximity to the smart meter. At the typical proximity to smart meters for people or animals, the exposure levels are so attenuated it is impossible to conclude, based on the animal study evidence presented here, that there is a credible risk of human harm from the RF emissions of CMP's smart meters.

4. Human Studies

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson have also put forward many studies that address the impact of RF emissions, EMF, and microwaves on the specific organs, body parts, and biological systems of humans. Most of the human studies involved the effects of RF emissions from cellular telephones.

Some of the studies have shown evidence of a statistical association with cell phone use and brain tumor risk, but most studies have not shown such an association. As with the animal studies, however, the RF exposure levels in the human studies are much greater—and particularly the studies involving very close proximity exposure to

cellular telephones, many orders of magnitude greater than the RF exposure levels associated with CMP's smart meters, even emissions measured in extremely close proximity to the smart meter. Moreover, even at the much higher exposures related to cellular phone use, there is no scientific consensus that this exposure is causal to harmful effects.

At the typical proximity to smart meters for people or animals, the exposure levels are so attenuated it is impossible to conclude, based on the human study evidence presented here, that there is a credible risk of harm from the RF emissions of CMP's smart meters.

5. World Health Association Classification of RF Emissions as Potentially Carcinogenic

The International Agency for Research on Cancer (IARC), an agency of the United Nations' World Health Organization (WHO), has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans. IARC released its findings in 2013 in *IARC Monograph Volume 102, "Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields."* The IARC concluded that there is limited evidence in both humans and animals for the carcinogenicity of radiofrequency radiation, and classified radiofrequency electromagnetic fields as "possibly carcinogenic to humans (Group 2B)."

A Class 2B classification means that RF EMF has been deemed as possibly carcinogenic to humans. RF EMF was designated as a class 2B carcinogen due to evidence associating glioma and acoustic neuroma, two types of brain cancer, with wireless telephone users. *Michigan Public Service Commission*, Case No. U-17000, Report to the Commission at 10 (Jun. 29, 2012) (MPSC Report). The WHO provided more detail as to why RF EMF was classified as a Group 2B carcinogen:

The international pooled analysis of data gathered from 13 participating countries found no increased risk of glioma or meningioma with mobile phone use of more than 10 years. There are some indications of an increased risk of glioma for those who reported the highest 10% of cumulative hours of cell phone use, although there was no consistent trend of increasing risk with greater duration of use. The researchers concluded that biases and errors limit the strength of these conclusions and prevent a causal interpretation. Based largely on these data, IARC has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), a category used when a causal association is considered credible, but when chance, bias or confounding cannot be ruled out with reasonable confidence.

VDH Report at 14 (quoting WHO Report).

Although the WHO's classification of RF emissions is an important consideration, its 2B classification was based on studies involving wireless phones, not smart meters. In addition, the IARC Group 2B classification is only a suggestion of a possible causal relationship with carcinogenic effects.⁵⁶ As shown in Section VII, above, while both wireless phones and smart meters emit RF, smart meters result in a substantially lower level of exposure to such emissions. Thus, and as discussed in Section XI(E)(1) above, the WHO classification does not change my conclusion that the existing science has not identified or confirmed negative health effects from RF emissions from smart meters.

6. Maine CDC

The Maine Center for Disease Control & Prevention (Maine CDC) is the agency in Maine charged with the responsibility to provide the leadership, expertise, information and tools to assure healthy conditions for all Maine people.⁵⁷ On November 8, 2010, the Maine CDC issued a report regarding health issues related to smart meters. *Maine CDC, "Maine CDC Executive Summary of Review of Health Issues Related to Smart Meters"* (Nov. 8, 2010) (Maine CDC Report). The Maine CDC reviewed materials submitted to the agency regarding smart meters, as well as health studies and assessments from government agencies and affiliated private and academic organizations including the World Health Organization, the FCC, the National Cancer Institute, the National Institutes of Health, and several Canadian and European agencies.

⁵⁶ IARC has several classifications of carcinogenicity. Group 1: The agent is carcinogenic to humans. This category is used when there is sufficient evidence of carcinogenicity in humans. Group 2A: The agent is probably carcinogenic to humans. This category is used when there is limited or inadequate evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. Group 2B: The agent is possibly carcinogenic to humans. This category is used for agents for which there is limited or inadequate evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. Group 3: The agent is not classifiable as to its carcinogenicity to humans. This category is used most commonly for agents for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals. Group 4: The agent is probably not carcinogenic to humans. This category is used for agents for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals. *World Health Organization, International Agency for Research on Cancer, Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 102 at 30-31 (2013).*

⁵⁷ The Maine CDC website contains information regarding its role in ensuring and evaluating health issues impacting Maine citizens.
<http://www.maine.gov/dhhs/mecdc/about-us.shtml>

The Maine CDC Report concluded:

[O]ur review of these agency assessments and studies do not indicate any consistent or convincing evidence to support a concern for health effects related to the use of radiofrequency in the range of frequencies and power used by smart meters. They also do not indicate an association of EMF exposure and symptoms that have been described as electromagnetic sensitivity.

Maine CDC Report at 4.

7. Electromagnetic Hypersensitivity

Many individuals have reported a heightened sensitivity to RF and EMF and have reported numerous health impacts associated with the RF emissions from smart meters, including physical and cognitive difficulties. However, to date, there are no dependable scientific studies that confirm the existence of such hypersensitivity.

The WHO has issued documents on the topic of possible existence of individual electromagnetic hypersensitivity (EHS), a condition in which certain people seem to be especially susceptible to EMF, exhibiting a wide range of physical afflictions. The studies typically attempted to elicit symptoms under controlled laboratory conditions. The WHO concluded that the symptoms experienced by those who have been described as EHS were not correlated with EMF exposure, and therefore there was no scientific basis to link EHS symptoms to EMF exposure. *WHO, "Electromagnetic Fields (EMF): Fact Sheets and Backgrounders" (available at <http://www.who.int/mediacentre/factsheets/fs296/en/index.html>)*. Accordingly, while I do not dispute that the individuals who report EHS may experience real symptoms, there is no evidence upon which to conclude that RF, and specifically RF from CMP's smart meters, is a cause of their symptoms. Moreover, as stated in Section XI(E)(6) above, the Maine CDC has concluded that studies have not indicated an association of EMF exposure and symptoms that have been described as electromagnetic sensitivity

F. Decisions of Health and Regulatory Agencies

As stated in Section XI(E)(6) above, the Maine CDC has concluded that there is no consistent or convincing evidence to support a concern for health effects related to the use of radiofrequency in the range of frequencies and power used by CMP's smart meters.⁵⁸ As the state agency in Maine with the responsibility and expertise to assess

⁵⁸ On November 5, 2012, the Commission informed the Maine CDC of this proceeding, and invited the Maine CDC to update or supplement its November 2010 report. The Maine CDC did not provide any further information in response to the Commission's November 5, 2012 letter.

public health concerns and risks, I place great weight on the Maine's CDC's assessment of the health and safety issues posed by CMP's smart meter program.⁵⁹

Moreover, I also place significant weight should be placed on the work and conclusions of other state health and regulatory agencies that have specifically considered the health impacts of utility smart meters.⁶⁰ Those assessments are discussed below.

1. California Council on Science and Technology

In April 2011, the California Council on Science and Technology (CCST) completed the CCST Report. The CCST is an independent, not-for-profit entity established by the California Legislature and is responsible for offering unbiased expert scientific advice to the state government on technology-related policy issues. The CCST compiled and assessed evidence to determine whether FCC standards for smart meters are sufficiently protective of public health and whether additional technology-specific standards are needed for smart meters to ensure adequate protection from adverse health effects. After evaluating the body of scientific literature and consultation with experts in radio and electromagnetic emissions regarding smart meters, CCST found that the FCC standards provide an adequate factor of safety against known RF health impacts of smart meters and other electronic devices in the same range of RF emissions. *CCST Report* at 7. Additionally, CCST found that there was no clear evidence that additional standards are needed because neither the scientific literature nor CCST's expert consultations support that there is a causal link between RF emissions and non-thermal health impacts. *Id.* at 8. Following the release of the CCST report, the Health Officer of the County of Santa Cruz Health Services Agency (Santa Cruz) issued a memorandum that was critical of the CCST report and concluded that there is no scientific data to determine if there is a safe RF exposure level regarding non-thermal effects. *Poki Stewart Namkung, M.D., M.P.H., Health Officer, County of*

⁵⁹ Ms. Wilkins, on page 3 of her Reply Brief, responds to CMP's reliance on the Maine CDC report by emphasizing e-mails in the record in which Dr. Dora Mills, the then Director of the Maine CDC, stated that she never said that "smart meters are safe." Such a statement is not surprising nor of any particular significance in that it is universally recognized that it is impossible to scientifically prove absolute safety. For example, the Lawrence Berkeley National Laboratory's Smart Grid Technical Advisory Project "Review of the January 13, 2012 County of Santa Cruz Health Services Agency memorandum: Health Risks Associated with Smart Meters" (April 12, 2012) states that while science can work to understand the cause of effects that are observed, it has never been able to declare anything completely safe.

⁶⁰ Ms. Wilkins, on page 3 of her post-hearing Brief, argues that the Commission should not rely on various government reports because they are not peer-reviewed. The issue of whether a document is peer-reviewed is taken into consideration when examining studies by scientists in academic journals, not when a governmental organization issues a report or a decision.

Santa Cruz Health Services Agency, "Health Risks Associated with Smart Meters" (Jan. 13, 2012). The Lawrence Berkeley National Laboratory's (LBNL) Smart Grid Technical Advisory Project examined Santa Cruz's memorandum and found its conclusion problematic. *Roger Levy and Janie Page, Smart Grid Technical Advisory Project, Lawrence Berkeley National Laboratory*, "Review of the January 13, 2012 County of Santa Cruz Health Services Agency memorandum: Health Risks Associated with Smart Meters" (April 12, 2012). LBNL questioned the Santa Cruz memo's accuracy, noting that the memo made statements that were technically and scientifically incorrect, that it did not provide a balanced review of the research, that many of the scientific sources used were not peer reviewed and that the memo relied extensively on one journal, denying itself exposure to a variety of sources. *Id.*

2. Michigan Public Service Commission

In June 2012, the Michigan Public Service Commission (MPSC) Staff issued a report after reviewing submitted comments, peer-reviewed scientific studies, and resources from other agencies. The MPSC Staff concluded that after reviewing the available literature and studies, the health risk from smart meters is insignificant. *MPSC Report* at 28. Additionally, the MPSC Staff concluded that federal health and safety regulations provide assurance that smart meters are a safe technology. *Id.*

3. Texas Public Utility Commission

In December 2012, the Staff of the Public Utility Commission of Texas reviewed the scientific research on the potential health effects of RF emitted by wireless devices including smart meters and released the PUC TX Report. The Texas Commission Staff concluded that decades of scientific research have not provided proof of biological effects from exposure to low-level RF signals from smart meters and that there was no credible evidence to suggest that smart meters emit harmful levels of RF.⁶¹ *PUC TX Report* at 62.

4. Vermont Department of Health

In February 2012, the Vermont Department of Health, in the VDH Report, concluded that the current regulatory standards for RF from smart meters are sufficient to protect public health. *VDH Report* at 1. The Department of Public Health made this conclusion after an extensive review of the available scientific literature and current FCC regulatory health protection standards.

⁶¹ In addition to assessing the RF associated with smart meters, the PUC TX Report also reviewed literature related to the ELF-EMF associated with smart meters. It referenced an Australian study that found that smart meters have lower ELF-EMF emissions than traditional analog electromechanical meters, as well as other common household appliances such as vacuum cleaners, hairdryers, power tools and fans. *PUC TX Report* at 46.

5. British Columbia Utilities Commission

In July 2013, the British Columbia Utilities Commission (BCUC) issued a decision in the Matter of FortisBC Inc., approving a Certificate of Public Convenience and Necessity (CPCN) for the AMI project of FortisBC. *In the Matter of FortisBC, Certificate of Public Convenience and Necessity for the Advanced Metering Infrastructure Project, Decision* (Jul. 23, 2013) (FortisBC Decision). In approving the CPCN for the AMI project, the BCUC conducted an extensive public hearing process that included testimony from the public and scientific experts on smart meters.

The BCUC found that Safety Code 6, the code adopted by Health Canada that specifies Canada's radiofrequency exposure guidelines, provides an appropriate degree of precaution in setting limits on RF emissions and that the RF emissions from the smart meters are significantly below the levels set out in Safety Code 6.⁶² Safety Code 6 is similar to the FCC standards. The BCUC also stated that while some individuals may feel strongly that smart meters will have a negative impact on their health, the scientific evidence did not persuade the BCUC that there is a causal connection between RF emissions and the symptoms of electromagnetic hypersensitivity. *Id.* at 137.

6. Health Canada

In December 2011, Health Canada, the Canadian governmental department concerned with public health, concluded that exposure to RF energy from smart meters does not pose a public health risk. *Health Canada, "It's Your Health- Smart Meters"* (Dec. 2011).⁶³ Health Canada noted that unlike cellular phones, where the transmitter is close to the head and the RF energy that is absorbed is localized to one specific part of the body, the RF from smart meters is generally transmitted at a much greater distance from the body. Health Canada noted that this leads to very low RF exposure levels across the entire body, similar to exposure to AM or FM radio broadcast signals. Health Canada also found that because exposure levels were below both Safety Code 6 and international safety limits, it did not consider any precautionary measures necessary. Additionally, Health Canada found that even where multiple smart meters are together, the exposure level will still be well below Safety Code 6 due to the infrequent nature of transmission.

G. Voluntary Use of Technology

Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson argue that, because CMP has not met its burden to prove that smart meters are safe, they should be removed and

⁶² Health Canada is the department of the Canadian government responsible for public health. Health Canada's "Safety Code 6 (2009)" is a code that specifies Canada's radiofrequency exposure guidelines.

⁶³ <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/prod/meters-compteurs-eng.php>

replaced with analog or wired meters. However, Mr. Friedman's witnesses generally do not advocate a ban on the use of RF emitting technologies. Rather, the emphasis of Mr. Friedman's witnesses is the need for further scientific study, the need for customer information on potential safety risks, the mandatory nature of smart meters and the availability of alternatives to smart meters.

For example, Dr. Leszczynski stated:

I do not oppose the use of cell phones. Also, for any such action it is too late because this technology is omnipresent. However, the users should not be misled by statements that the current safety standards protect them from the effects of cell phone radiation. . . . Phones should have warning labels and ways of safe using cell phones, at the same time limiting exposures to radiation, should be actively promoted in the society. Smart meters is a new technology that is still not omnipresent and it would be prudent to stop implementing it at this stage. There are other methods to transfer information about the electricity usage. Smart meter radiation should be studied more before smart meters become omnipresent.

Data Request EXM-012-003.

Similarly, Mr. Morgan stated that CMP should be required to post warning signs on smart meters and notes that such warnings are required for other RF EMF emitters. *Morgan Test.* at 26; *Data Request EXM-004-009.*

Other of Mr. Friedman's witnesses draw a distinction between cell phones (and other RF emitting devices) and smart meters on the basis that the use of cell phones is "voluntary," while smart meter installations and exposure are "mandatory." For example, Dr. Hardell stated that "[e]xposure to RF-EMF from smart meters is without consent in contrast to the use of wireless phones that are used by the individual's own choice." *Hardell Test.* at 29. Dr. Carpenter stated that:

In the case of smart meters there is a clear and obvious alternative, which is to leave the analogue meters in place....I am not opposed to all wireless employment, but urge that steps be taken whenever possible to reduce human exposure.... In the case of wireless smart meters, there is no benefit to the home owner, only to the utility, and they should not be installed anywhere. At the very least individuals must be able to opt-out of wireless smart meters without having to pay a fee to avoid possible harm or having any fiscal liability, which many cannot afford. Individuals must be allowed to control their own environment.

*Data Request EXM-017-004.*⁶⁴

Dr. De-Kun Li stated that the "use of cell phones is a voluntary exposure . . . [g]iven that installation of smart meters is mandatory in most places, RF EMF exposure from smart meters is an 'involuntary exposure.'" *De-Kun Li Test.* at 6.

Finally, Mr. Friedman, Ms. Wilkins, and Ms. Foley-Ferguson express a concern that, even if individual customers can choose not to have a smart meter, they are still exposed to smart meter emissions from their neighbors and the mesh system.

In response, I interpret the views of Mr. Friedman's witnesses, as summarized above, as expressions of opinions about public policy based on individual assessments of the value and nature of particular technologies. Most would agree that cell phones, Wi-Fi and other commonly used RF emitting devices should not be banned, even given possible health effects, because of the usefulness and popularity of such devices. Although not highly valued by some, as described in Section IV above, wireless smart meters also provide public benefits that are relevant to the policy question. The consequence of prohibiting smart meters would be the loss of significant public benefits.

Moreover, I disagree with Mr. Friedman's witnesses with respect to their point that smart meters are fundamentally different than other devices – e.g., cell phones – in terms of the voluntary nature and the availability of alternatives. Again, this assessment is a matter of public policy judgment. It is true that customers choose to use cell phones. It is also true that there is an alternative to cell phones: *i.e.*, wired phone service. In fact, there are currently non-RF alternatives to most, if not all, commonly used consumer RF emitting devices, including smart meters. CMP's customers have a choice not to have a smart meter on their premises through the opt-out program.⁶⁵ Moreover, as is true for smart meters, individuals are exposed to the RF emissions of other devices in their neighborhoods and communities, such as in most offices, libraries, retail stores, and restaurants. Finally, it is clear from the record that smart meters contribute a small fraction of the total RF to which the public is exposed in a typical environment, thus, eliminating smart meters would have a negligible effect on RF exposure levels.

⁶⁴ Dr. Hardell and Mr. Hart agree: Dr. Hardell stated that "The customer must have a choice not to have a smart meter installed with no cost." *Data Request EXM-014-002.* Mr. Hart stated: "An 'opt out' with associated fees has coercive or extortive effects on sensitive and non-sensitive populations alike and thus certainly has the effect of being a forced deployment." *Data Request EXM-011-001.*

⁶⁵ The issue of whether customers should have to pay to opt-out, in my view, is not before the Commission in this proceeding. Furthermore, the question posed to the Commission by the Law Court was whether smart meters posed a credible threat of harm to the public. The answer to this question is not dependent on the economic rate-making treatment of an opt-out provision.

XII. CONCLUSION

For all the reasons discussed above and based on the record in this proceeding, we conclude that CMP's installation and operation of its smart meter system poses no credible threat of harm to the public or CMP's customers and is therefore safe on this record, and is consistent with the Company's statutory obligation to furnish safe, reasonable and adequate facilities and service. However, we note that our decision is based on the current state of the science as reflected in that record. As referenced above, the WHO and National Research Council have identified a number of research priorities in the area of RF exposure that may yield in the future important findings regarding all RF/EMF emitting devices such as wireless smart meters. There are also inconsistencies in some areas of the research that could be resolved with further research. In the meantime, this Commission and regulators must make our best determinations based on the science available to us at the present time and the evidence in the record before us, recognizing that such science will continue to evolve.

XIII. ORDERING PARAGRAPH

In light of the foregoing, we,

O R D E R

That the investigation opened regarding the complaint filed on July 29, 2011 by Ed Friedman and eighteen other persons pursuant to 35-A M.R.S. § 1302 is hereby concluded.

Dated at Hallowell, Maine this 19th Day of December, 2014

BY ORDER OF THE COMMISSION

/s/ Harry Lanphear

Harry Lanphear
Administrative Director

COMMISSIONERS VOTING FOR: Littell
 Vannoy

COMMISSIONERS NOT PARTICIPATING: Welch

NOTICE OF RIGHTS TO REVIEW OR APPEAL

5 M.R.S. § 9061 requires the Public Utilities Commission to give each party to an adjudicatory proceeding written notice of the party's rights to review or appeal of its decision made at the conclusion of the adjudicatory proceeding. The methods of review or appeal of PUC decisions at the conclusion of an adjudicatory proceeding are as follows:

1. Reconsideration of the Commission's Order may be requested under Section 11(D) of the Commission's Rules of Practice and Procedure (65-407 C.M.R.ch. 110) within **20** days of the date of the Order by filing a petition with the Commission stating the grounds upon which reconsideration is sought. Any petition not granted within **20** days from the date of filing is denied.
2. Appeal of a final decision of the Commission may be taken to the Law Court by filing, within **21** days of the date of the Order, a Notice of Appeal with the Administrative Director of the Commission, pursuant to 35-A M.R.S. § 1320(1)-(4) and the Maine Rules of Appellate Procedure.
3. Additional court review of constitutional issues or issues involving the justness or reasonableness of rates may be had by the filing of an appeal with the Law Court, pursuant to 35-A M.R.S. § 1320(5).

Note: The attachment of this Notice to a document does not indicate the Commission's view that the particular document may be subject to review or appeal. Similarly, the failure of the Commission to attach a copy of this Notice to a document does not indicate the Commission's view that the document is not subject to review or appeal.